REPORT OF WASTE DISCHARGE

FOR THE

LOS OSOS WASTEWATER PROJECT

LOS OSOS COMMUNITY SERVICES DISTRICT

June 28, 2002

MWH
MONTGOMERY WATSON HARZA

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

1. FACILITY INFORMATION

A. Facility:

Name: Los Osos Wastewater Treatment Facility			
Address: Ravenna Avenue (Adjacent to Los Osos Valley Road)			
City: Los Osos	County: San Luis Obispo	State: CA	Zip Code: 93402
Contact Person: Bruce Buel, General Manager		Telephone Number: (805) 528 - 9370	

B. Facility Owner:

Name: Los Osos Community Services District			Owner Type (Check One) 1. ☐ Individual 2. ☐ Corporation 3. ☒ Governmental Agency 4. ☐ Partnership 5. ☐ Other: ______
Address: 2122 9th Street			
City: Los Osos	State: CA	Zip Code: 93402	
Contact Person: Bruce Buel, General Manager		Telephone Number: (805) 528 - 9370	Federal Tax ID: 77 - 0504518

C. Facility Operator (The agency or business, not the person):

Name: Same as Item B above.			Operator Type (Check One) 1. ☐ Individual 2. ☐ Corporation 3. ☐ Governmental Agency 4. ☐ Partnership 5. ☐ Other: ______
Address:			
City:	State:	Zip Code:	
Contact Person:		Telephone Number:	

D. Owner of the Land:

Name: Same as Owner			Owner Type (Check One) 1. ☐ Individual 2. ☐ Corporation 3. ☐ Governmental Agency 4. ☐ Partnership 5. ☐ Other: ______
Address:			
City:	State:	Zip Code:	
Contact Person:		Telephone Number:	

E. Address Where Legal Notice May Be Served:

Address: Same as Owner		
City:	State:	Zip Code:
Contact Person:		Telephone Number:

F. Billing Address:

Address: Same as Owner		
City:	State:	Zip Code:
Contact Person:		Telephone Number:

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11. TYPE OF DISCHARGE

Check Type of Discharge(s) Described in this Application (A or B):

[X] **A. WASTE DISCHARGE TO LAND** [ ] **B. WASTE DISCHARGE TO SURFACE WATER**

Check all that apply:

[X] Domestic/Municipal Wastewater Treatment and Disposal	[ ] Animal Waste Solids	[ ] Animal or Aquacultural Wastewater
[ ] Cooling Water	[ ] Land Treatment Unit	[ ] Biosolids/Residual
[ ] Mining	[ ] Dredge Material Disposal	[ ] Hazardous Waste (see instructions)
[ ] Waste Pile	[ ] Surface Impoundment	[ ] Landfill (see instructions)
[X] Wastewater Reclamation	[ ] Industrial Process Wastewater	[ ] Storm Water

[ ] Other, please describe: __________

111. LOCATION OF THE FACILITY

Describe the physical location of the facility.

1. Assessor's Parcel Number(s)	2. Latitude	3. Longitude
Facility: 074-229-017	Facility: 35° 18' 40"	Facility: 120° 50' 24"
Discharge Point: 074-022-074	Discharge Point: 35° 18' 22"	Discharge Point: 120° 50' 40"

IV. REASON FOR FILING

[X] New Discharge or Facility	[ ] Changes in Ownership/Operator (see instructions)
[ ] Change in Design or Operation	[ ] Waste Discharge Requirements Update or NPDES Permit Reissuance
[ ] Change in Quantity/Type of Discharge	[ ] Other: __________

V. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Name of Lead Agency: Los Osos Community Services District

Has a public agency determined that the proposed project is exempt from CEQA? [ ] Yes [X] No

If Yes, state the basis for the exemption and the name of the agency supplying the exemption on the line below.

Basis for Exemption/Agency: __________

Has a "Notice of Determination" been riled under CEQA? [X] Yes [ ] No

If Yes, enclose a copy of the CEQA document, Environmental Impact Report, or Negative Declaration. If no, identify the expected type of CEQA document and expected date of completion.

Expected CEQA Documents:

[X] EIR [ ] Negative Declaration

Expected CEQA Completion Date: Final EIR Certified March 1, 2001

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VI. OTHER REQUIRED INFORMATION

Please provide a COMPLETE characterization of your discharge. A complete characterization includes, but is not limited to, design and actual flows, a list of constituents and the discharge concentration of each constituent, a list of other appropriate waste discharge characteristics, a description and schematic drawing of all treatment processes, a description of any Best Management Practices (BMPs) used, and a description of disposal methods.

Also include a site map showing the location of the facility and, if you are submitting this application for an NPDES permit, identify the surface water to which you propose to discharge. Please try to limit your maps to a scale of 1:24,000 (7.5'USGS Quadrangle) or a street map, if more appropriate.

VII. OTHER

Attach additional sheets to explain any responses which need clarification. List attachments with titles and dates below:

Refer to attached sheet for addtional information

You will be notified by a representative of the RWQCB within 30 days of receipt of your application. The notice will state if your application is complete or if there is additional information you must submit to complete your Application/Report of Waste Discharge, pursuant to Division 7, Section 13260 of the California Water Code.

VIII. CERTIFICATION

"I certify under penalty of law that this document, including all attachments and supplemental information, were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

PrintName: Bruce S. Buel **Title.** LOCSD General Manager

Signature: [signature] **Date:** 7/8/02

FOR OFFICE USE ONLY

Date Form 200 Received:	Letter to Discharger:	Fee Amount Received:	Check #:

APPLICATION/REPORT OF WASTE DISCHARGE

VII. OTHER

Attachments

Project Description

Notice of Determination

"Nitrate Monitoring Program Design" dated February 2002 prepared by Cleath & Associates

"WWTF Drainage Report" dated April 22, 2002 prepared by MWH and EDA

"Final Environmental Impact Report" certified March 1, 2001 and prepared by Crawford, Multari, & Clark Associates (Enclosed under separate cover)

REPORT OF WASTE DISCHARGE

for the

LOS OSOS WASTEWATER PROJECT

PROJECT DESCRIPTION

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Nitrate Monitoring Program Design
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INTRODUCTION

The community of Los Osos is located along the central coast of California on the southern edge of Morro Bay in San Luis Obispo County as indicated in Figure 1.

Figure 1 - Project Location

Los Osos is a residential community of approximately 14,600 residents. The community's drinking water system consists of a series of groundwater wells in the Los Osos area. The community's existing wastewater system is composed of individual septic tanks and associated leach fields/pits. The Los Osos Community Services District (District) is the government body responsible for wastewater management within the community.

The District has obtained approval from regulatory agencies for the Final Project Report prepared by Montgomery Watson Harza (MWH) dated March 2001 and the Environmental Impact Report prepared by Crawford, Multari, & Clark Associates (CMCA) dated March 2001 for the Los Osos Wastewater Collection, Treatment, and Disposal System (Project). The proposed project will replace the existing septic tank wastewater system with a conventional sewer collection system with pump stations, a centralized wastewater treatment facility, and distributed effluent disposal system.

PROJECT BACKGROUND

Groundwater resources in the Los Osos area are divided into four distinct aquifers. The inferred geotechnical fault that roughly coincides with an alignment that parallels Ferrell Avenue marks the division of the groundwater resources into an eastside aquifer and a westside aquifer. In addition, an aquatard further separates both the eastside and westside aquifers into an upper and lower aquifer. In general, the upper aquifer is within 150 feet of the ground surface and the lower aquifer is below approximately 190 feet of the ground surface. Most of the community's drinking water wells draw groundwater from the lower aquifers.

Water quality data collected by the California Central Coast Regional Water Quality Control Board (RWQCB) shows elevated levels of nitrate are present in the upper aquifers on both the eastside and westside of the community. High nitrate levels in drinking water are a public health concern, particularly for newborns where it can cause "blue baby syndrome". To protect public health, the California Department of Health Services (DHS) has established a drinking water limit of 10 mg/l nitrate (as N) in drinking water supplies.

In the early 1980's, nitrate levels in the upper aquifers within Los Osos exceeded the drinking water limit of 10 mg/l (as N). In several areas, water quality data suggested that that a buildup of nitrate was occurring in the upper aquifers. The primary source of nitrate contamination was identified by the RWQCB to be septic tanks and their associated leach fields. As a result, the RWQCB amended its Basin Plan and adopted Resolution 83-13 that prohibits the use of septic tanks with leach fields and seepage pits within the Prohibition Zone of Los Osos. Subsequently, a building moratorium was imposed on Los Osos in 1988 to limit growth and the addition of new septic tanks within the Prohibition Zone. This building moratorium has continuously been in effect since 1988. The Prohibition Zone is delineated in Figure 2.

Four areas of the community are not included in the Project ~~Prohibition~~ Zone. These areas are Bayview Heights, the Martin Tract, Monarch Grove, and Sea Pines Resort. Bayview Heights and the Martin Tract are not included because the lot sizes are greater than 1 acre. Monarch Grove and Sea Pines Resort are not included because wastewater from these areas is currently collected and treated by a package wastewater treatment plant owned and operated by the Monarch Grove Homeowner's Association.

PROJECT SCHEDULE

incorrect

On October 27, 2000 the RWQCB replaced Resolution 83-13 with Time Schedule Order No. 00-131. This order requires the District to demonstrate progress on a wastewater project by meeting a series of delivery dates. Specifically, the order identifies the following key dates:

- December 15, 2000 — Submit proof of Draft Environmental Impact Report
- April 1, 2001 — Submit final California Environmental Quality Act document
- July 29, 2001 — Submit proof of voter approval of assessment district or comparable means of financing community wastewater system
- July 15, 2002 — Submit approved complete construction design plans
- July 15, 2002 — Submit County Use and Coastal Development permits
- September 6, 2002 — Commence construction of community sewer system
- August 30, 2004 — Complete construction of community sewer system

The District was also required and successfully submitted a Facilities Plan and Funding Plan to the SWRCB by March 30, 2001. These submittals were required to maintain the District's eligibility for the low interest loan funding from the State Revolving Fund (SRF) administered by the State Water Resources Control Board. The District obtained SRF loan approval from the SWRCB in January 2002. In addition, property owners within the community voted with an over an 80 percent favorable margin on formation of an assessment district to fund the project in June 2001. The District subsequently adopted a resolution to form the assessment district in June 2001.

As of June 2002 the District was in compliance with all of the above deadlines. However, the District is currently enmeshed in litigation that is attempting to stop the project. Until the litigation is resolved the District is unable to issue and sell bonds needed to provide funding for costs that are not eligible under the SRF loan. Until bond financing can be obtained, the District cannot authorize engineering services for final design of the project. Consequently, for reasons beyond the control of the District, the District will not meet the July 15, 2002 deadline for completion of construction contract documents.

PUBLIC INVOLVEMENT

The selected wastewater project to meet the regulatory requirements also needed to address community concerns. The document entitled "Vision Statement for Los Osos", developed by the Los Osos Community Advisory Council in 1995, identified key community values that highlight the need for development of a sound wastewater management project. These values include:

- Decision-making based on a philosophy of sustainable development
- Managing the watershed in a manner that is consistent with protection of the Morro Bay Estuary
- Holistically managing local water resources to ensure its long-term viability
- Maintaining, managing, and recharging the local aquifer, preventing over-drafting of the aquifer and salt-water intrusion into the water supply
- Managing wastewater, cleansing, and restoration to the lower aquifer or upper aquifer with pumping from upper aquifer for domestic use
- Reclaiming and conserving local water resources
- Developing a wastewater treatment facility based on a natural biological process rather than a mechanical system approach to the highest extent possible
- Creating a wastewater treatment facility that is a visual and recreational asset to the community, provides water for irrigation, agriculture, and habitat for wildlife
- Creating a wastewater project that is affordable to the community.

The evaluation of the proposed wastewater project alternatives within the community of Los Osos considered these strongly held community values. Representatives from the community worked with District staff and Montgomery Watson to ensure that these community values were incorporated into the decision-making process. Three key evaluation criteria that reflect the ideas contained in the community's "Vision Statement" and their impact on project components are shown in Table A.

Table A - Evaluation Criteria and Project Components

	Project Component				
Criteria	**Collection**	**Treatment Process**	**Facility Site**	**Effluent Disposal**	**Biosolids Disposal**
Cost	✓	✓	✓	✓	✓
Resource Sustainability		✓	✓	✓	✓
Community Acceptance	✓	✓	✓	✓	✓

As shown in the table, the treatment process and facility site are the most affected by community values. Two workshops were held with the community during the preparation of the Project Report to more clearly assess how well these two components met the community's criteria. In addition, nine community workshops were conducted from October 2001 to January 2002 to address the technical aspects of the proposed wastewater project.

WATER SUPPLY

The water supply for the Los Osos community is groundwater from the aquifers previously described. The three water purveyors that serve the community and their respective existing average water production are presented in Table B. The water production data is taken from the report entitled "Water Master Plan" dated June 2001 prepared by John L. Wallace and Associates.

Table B – Existing Water Production

Description	Average Production
Los Osos Community Services District	0.98 mgd
California Cities Water	0.92 mgd
S&T Mutual Water Company	0.14 mgd
Total	2.04 mgd

The Water Master Plan also reports that the quality of the water distributed to District customers meets all primary and secondary standards established by the United States Environmental Protection Agency and the California Department of Health Services with one exception. The single exception is copper. The District will be implementing corrosion control measures with the addition of ortho-phosphate to mitigate the copper corrosion. Water quality data of selected parameters from the Water Master Plan are presented in Table C.

Table C – Water Quality Data

Description	Value (ppm)
Nitrate (as N)	ND – 3.3
Chloride	33 – 60
Sulfate	33 – 60
Sodium	21 – 47
Total Dissolved Solids	160 – 420
Hardness (as CaCO3)	79 - 280

ND = Not Detected

The District will implement a water conservation program with the installation of low-flow plumbing fixtures. The use of water softeners within the District service area will be prohibited. The District has adopted a long-term, comprehensive monitoring program to evaluate the changes in nitrate and minerals in the Los Osos groundwater basin. A report entitled "Nitrate Monitoring Program Design" dated February 2002 prepared by Cleath & Associates is attached for reference.

DISCHARGE CHARACTERISTICS

The estimates provided below form the basis of the 20 year capacity needs for all components of the project. The community of Los Osos is expected to achieve full build-out in the year 2020. As a result, capacity estimates for the year 2020 also reflect capacity needs to the year 2040.

The estimated build-out population of the community that will be included in the collection system by the year 2020 is equivalent to 18,428 people with an estimated 4,774 connections. These estimates were developed by the Wastewater Committee based on population projections from the 1990 Census and the County of San Luis Obispo. The estimates reflect a great deal of local knowledge about existing and future development.

The estimated wastewater flow associated with this build-out population ranges from an average dry weather flow of 1.3 mgd to an average wet weather flow of 1.6 mgd. The per capita flow for average dry weather is estimated to currently be 77 gpd. Once water conservation measures are implemented the average dry weather per capita flow is expected to be 69 gpd. The per capita wet weather infiltration/inflow (I/I) is 17 gpcd.

Based on the residential nature of the population, the wastewater flow generated in Los Osos will be predominantly residential in character. Small commercial loads from restaurant and retail sales sources are expected to be less than 3% of the flow. Virtually no loads are expected from industrial sources. For these reasons, it is expected that the concentration of BOD, suspended solids, and ammonia will be of residential strength.

The projected wastewater characteristics are summarized in Table D.

Table D – Projected Wastewater Characteristics

Parameter	Average Day	Peak Day
Flow	1.3 mgd	1.6 mgd
BOD	260 mg/l	330 mg/l
Suspended Solids	260 mg/l	330 mg/l
Total Nitrogen	30 mg/l	40 mg/l

The WWTF will be designed to meet a Total Nitrogen content of 7 mg/l (as N) and Title 22 Requirements for disinfected tertiary recycled water (MPN of 2.2 / 100 ml within last 7 days and average turbidity of 2 NTU).

how if [illegible] plan [illegible] implemented [illegible] successful + septage

PROPOSED WASTEWATER PROJECT

The proposed wastewater project is designed to collect, treat, and dispose of wastewater from the community build-out population of 18,428 people that will be reached in Year 2020. The project consists of a conventional collection system with pump stations, an extended aeration wastewater treatment facility with solids handling facilities to produce Class B biosolids, and a distributed effluent disposal system that will utilize subsurface leachfields for disposal and provide for potential water reclamation with landscape irrigation. A description of each wastewater project component is presented below.

Collection System

A preliminary layout of the collection system and the preliminary location of wastewater pump stations are shown in Figure 2. The major components of the system are summarized in Table E.

Table E - Recommended Collection System Components

Item	Description
Number of connections	4,774
Length of collection sewers	169,000 ft
Length of sewer mains	35,000 ft
Number of pump stations	10
Predominant sewer diameter	8 inch
Pipe material	PVC

The collection system will be divided into four geographic areas based on drainage characteristics. The effluent disposal system that will be designed by a separate design team will be integrated into the collection system construction packages for bidding and construction.

The basis of design for the wastewater collection system will be to design the main sewers, trunk sewers, and laterals in a manner that will maximize gravity connections and to minimize pumped connections for property owners. The sewers for a given drainage area will be routed to pump stations that will be designed to convey the collected wastewater via force main to subsequent gravity sewers for ultimate delivery to the WWTF.

The wastewater pump stations will be submersible pump stations with underground wet wells and valve vaults. The wastewater pump stations will be designed with standby power capability. The basis of design for the standby power facilities will assume the installation of diesel engine-generator sets. The potential use of natural gas fired microturbines will be evaluated. The pump stations and standby power facilities will be designed with communication to the system-wide Supervisory Control and Data Acquisition (SCADA) system.

The collection system design may also include "pocket" wastewater pump stations located in the street right-of-way. The pocket pump stations would be submersible grinder pump stations with underground wet wells to serve up to 50 single-family residences. The stations will be designed to provide up to 12 hours of storage capacity at average flow and eliminate the installation of a permanent standby power facility.

Wastewater Treatment Facility

A conceptual site plan of the wastewater treatment facility (WWTF) located at the Tri-W site adjacent to the intersection of Ravenna Avenue and Los Osos Valley Road is shown on Figure 3. A site layout, process flow schematic, hydraulic profile, residuals schematic, and an odor control schematic are shown in Figure 4, 5, 6, 7, and 8, respectively.

The WWTF will be incorporated into the adjoining park setting and community facilities. The treatment facilities will be enclosed and/or buried with the exception of the secondary clarifiers that will be screened from view. Building enclosures will be designed with exterior architectural treatment and landscaping. Confinement and ventilation of potential odor sources will be provided.

The WWTF will consist of the following facilities:

- Influent Pump Station. An influent pump station similar to the wastewater pump stations for the collection system will be provided. The submersible pump station will convey wastewater delivered by gravity sewers to the WWTF site. The influent pump station wet well be enclosed and ventilated to contain and capture potential odors.

- Plant Drainage Pump Station. A plant drainage pump station similar to the influent pump station will be provided to receive plant drainage from treatment process areas (return flows and floor drainage) and convey the plant drainage to the headworks. The plant drainage pump station wet well be enclosed and ventilated to contain and capture potential odors.

- Headworks. The headworks will receive raw wastewater from the influent pump station and collection system pump stations. The raw wastewater will be pretreated with mechanical screening and grit removal. The screening facility and grit tank will be enclosed and ventilated to contain and capture potential odors. The headworks will be integrated with the solids handling facility.

- Septage Handling Facility. The septage handling facility will consist of truck unloading to store and convey septage to the Influent Pump Station for transfer to the headworks for pretreatment. The septage handling equipment will be enclosed and ventilated to contain and capture potential odors.

- Denitrification Basins. Two denitrification basins will be provided to receive pretreated wastewater from the headworks. Each basin will consist of three compartments with mechanical mixers.

- Extended Aeration Basins. Two extended aeration basins will be provided to receive wastewater from the denitrification basins. Each aeration basin will be equipped with a fine bubble diffused aeration system. The aeration basins will be buried and earth-covered to provide an area for an above-grade dog park. The area above the buried aeration basins will be equipped with a subsurface drainage system to provide adequate drainage.

- Clarifiers. Two circular secondary clarifiers will be provided for settling the mixed liquor from the extended aeration basins.

- Secondary Treatment Building. A portion of the extended aeration basins, the denitrification basins, and an area between the denitrification basins and the secondary clarifiers will be enclosed to house the return activated sludge pumps, waste activated sludge pumps, secondary scum pumps, aeration blowers, and standby power facility. The building will be designed to accommodate access to and removal of mechanical equipment. An electrical room to house the electrical service entrance, metering, transformer, switchgear, motor control centers, and related electrical gear will be located near the standby power system.

- Filters. Filters will be provided to provide tertiary treatment of the secondary effluent. The filters will be enclosed to house ancillary equipment for chemical addition, backwash, and air scour.

- UV Disinfection. UV disinfection modules will be provided adjacent to the filters to disinfect the filtered effluent. The UV disinfection system will be enclosed with the building housing the filters. Backup sodium hypochlorite facilities will be provided for intermittent process control, treating algae contamination in the secondary clarifiers and UV disinfection modules, and emergency effluent disinfection.

- Effluent Pump Station. An effluent pump station will be designed to convey the disinfected tertiary recycled water to the effluent disposal system sites – leachfields and reclaimed water irrigation. The tertiary effluent will also be used to meet utility water needs for the WWTF and adjacent landscape irrigation demands. The effluent pump station will be housed in the filter/UV disinfection building and will be located above an effluent reservoir that will be provided for effluent storage and balancing.

- Solids Handling. The solids handling facilities will consist of thickening, stabilization, and dewatering processes for the biological solids produced by the liquid treatment processes. Thickening of the waste activated sludge will be accomplished with two 1.0 M gravity belt thickeners with washwater pumps located over aerobic digestion tanks. Sludge stabilization will consist of aerobic digestion tanks with blowers. Dewatering will include two 1.0 M belt presses with sludge feed pumps, washwater pumps, and dewatered cake conveyance. A polymer storage, activation, and feed system will be provided to condition the sludges prior to the thickening and dewatering operations.

  The solids handling equipment will be housed in a two-story building with the gravity belt thickeners and belt presses installed on the upper floor. The discharge of dewatered sludge from the belt presses will be conveyed to a loading aisleway in the lower floor of the building. The biosolids disposal method is off-site disposal/recycling. Potential odor areas within the solids handling building will be enclosed and ventilated to contain and capture foul air.

- Operations Building. An Operations Building for SCADA/control room, laboratory, office, conference room, restrooms, shower and locker rooms, maintenance shop, and spare parts storage will be provided. The occupied spaces of the Operations building will be heated and cooled.

- Odor Control. An odor control system consisting of a biofilter with associated fans and ductwork will be provided. The biofilter will be designed to treat the foul air that is contained and captured from the process areas previously described. The biofilter will be concrete lined and consist of media with geotextile, underdrain, and wetting system.

- Acoustical Mitigation. Acoustical mitigation will be provided to reduce noise levels from equipment areas to acceptable levels for worker protection within facilities and for community acceptance at the property boundary.

- Instrumentation/SCADA. Instrumentation and controls will be provided for collection system pump stations and standby power facilities, the wastewater treatment facility, the effluent disposal system, and harvest wells. A Supervisory Control And Data Acquisition (SCADA) system will manage the status, alarms, and control of these facilities. The communication between the wastewater treatment facility and the remote sites (pump stations, effluent disposal sites, and harvest wells) will consist of radio telemetry, fiber-optic cable, or combination of both.

- Sitework. The sitework for the WWTF will include grading, paving, yard piping, utilities, and fencing. Grading, storm drainage piping, and a stormwater basin will be provided to control on-site surface runoff from the treatment facilities and subsurface drainage collected above the buried extended aeration basins. An erosion control plan for the WWTF will be prepared. Paving will be provided for roadways, parking, and sidewalks. Underground piping for interconnection of liquid treatment and solids handling processes and support utilities will be included. The site design will include the extension of Ravenna Avenue from LOVR to the Wastewater Treatment Facility entrance. No roadway improvements of LOVR are included. Fencing for site security will be provided.

- Off-Site Drainage. Off-site drainage will be collected along LOVR and pretreated with a sedimentation basin followed by overflow to a percolation basin. Flow in excess of the hydraulic capacity of the percolation basin will be routed to a discharge location at the northwest corner of the site. The percolation basin will function as a community playfield during dry weather. A preliminary Drainage Report prepared for San Luis Obispo County is attached for reference.

- Landscaping. The landscaping for the WWTF will address the immediate perimeter of the WWTF, the dog park, the on-site and off-site stormwater facilities, and the perimeter of the Tri-W site adjacent to Palisades Avenue, LOVR, and Ravenna Avenue. Irrigation will designed for the use of disinfected tertiary recycled water produced by the WWTF in compliance with Title 22 Regulations.

- Architectural. The design of the above-grade buildings will incorporate architectural treatment of the exterior elevations. The architectural treatment will be compatible with the landscaping design for the WWTF site and surrounding areas.

Effluent Disposal

The effluent disposal system will consist of an effluent transmission pipeline from the WWTF to the leachfield sites and potential water reclamation sites as shown on Figure 9 and 10, respectively. The transmission pipeline will be designed to serve nine leachfield sites. Each leachfield site will be designed with 100 percent redundancy and will be divided into a number of application zones. The connection to each application zone will be equipped with an isolation valve, flow control valve, and flow meter. The flow meter and flow control valve for each application field will be designed with communication to the system-wide SCADA.

The transmission pipeline design will include stub-outs for up to seven potential reuse customers (Sea Pines Golf Course, Monarch Grove Elementary School, WWTF site, Los Osos Community Center, Sunnyside Elementary School, Baywood Elementary School, and Los Osos Middle School). The turnouts for potential water reuse sites will be equipped with an isolation valve.

The transmission pipeline will be sized to deliver effluent to the leachfield sites for gravity discharge application and to the potential water reclamation sites. Booster pumps will be assumed to be required by water reclamation customers to meet the customer's service needs.

The recommended effluent disposal method uses constructed leach fields located throughout the community. Multiple effluent disposal sites are needed to meet conservative percolation criteria, maintain a minimum 30-feet vertical clearance to groundwater, and to preserve adequate distance to the nearest municipal well. The total effluent design capacity is 1.4 mgd to match the average annual flow of the wastewater system. The design criteria for the multiple disposal sites are shown in Table F.

Table F – Effluent Disposal Site Criteria

Site	Area (sf)	Disposal Capacity (gpd)	Approximate Distance to Municipal Well (ft)
<u>West Side</u>			
Broderson Site	300,000	800,000	600
LOVR / Pine St	30,000	50,000	550
Ziebarth Property	45,000	75,000	700
Vista de Oro	15,000	25,000	800
MG Elementary School	53,000	Standby	400
<u>East Side</u>			
Pismo Avenue	138,000	150,000	1,200
Santa Maria Avenue	138,000	175,000	1,500
South Bay Boulevard	60,000	125,000	3,500
Los Osos Middle School	20,000	Standby	3,400
Total		**1,400,000**	

Harvest wells to prevent the surfacing of groundwater in low-lying areas, will be utilized to draw from the upper aquifer. The locations of the harvest wells are shown on Figure 9. The harvest wells will be equipped with disinfection equipment to provide potable water. The water extracted from the upper aquifer will be blended with groundwater from the lower aquifer as required to insure that nitrate drinking water standards are met. The installation of monitoring wells will allow periodic measurement of groundwater levels and the capability to obtain groundwater samples at key locations in the vicinity of the leachfield sites.

PERMITS AND APPROVALS

The anticipated permits and approvals needed for the Los Osos Wastewater Project are presented in Table G.

Table G – Permits and Approvals

Description	**Agency Jurisdiction**
Coastal Development Permit (Development Plan)	SLO County Planning Commission California Coastal Commission
General Plan Amendment	SLO County Board of Supervisors California Coastal Commission
Section 7 Permit	US Fish and Wildlife Services California Dept of Fish and Game
Habitat Conservation Plan (Section 10 Permit, Memorandum of Understanding)	US Fish and Wildlife Services California Dept of Fish and Game
Archaeology Approval (Section 106 Permit, Memorandum of Understanding)	State Office of Historic Preservation
CEQA (Supplemental EIR)	LOCSD
Wetlands Permit (May not be needed)	Army Corps of Engineers
Value Engineering Package	SWRCB
Final Contract Documents	SWRCB
ATA Package	SWRCB
Final Revenue Plan	SWRCB
Performance Certification	SWRCB
Waste Discharge Permit	RWQCB
Storm Water Pollution Prevention Plan	RWQCB
Construction Dewatering Approval	RWQCB
Engineering Report (Recycled Water)	California Department of Health Services
Harvest Wells	California Department of Health Services
Hazardous Materials Management Plan	California Department of Health Services
Building Permits	SLO County Planning and Building Dept
Lateral Connection Permits	SLO County Planning and Building Dept
Erosion Control/Planting/Revegetation Plan Approval	SLO County Planning and Building Dept
Encroachment Permits	SLO County Dept of Public Works
Grading/Drainage Plan Approval	SLO County Dept of Public Works
Construction Traffic Mitigation Plan	SLO County Dept of Public Works
Air Pollution Control Permit	SLO County Air Pollution Control

REFERENCES

"Wastewater Facilities Project, Final Project Report" for the Los Osos Community Services District dated March 7, 2001 prepared by Montgomery Watson Americas, Inc.

"Draft Environmental Impact Report for the Los Osos Community Services District Wastewater Facilities Project" dated November 2001 prepared by Crawford, Multari, & Clark Associates.

"Final Environmental Impact Report for the Los Osos Community Services District Wastewater Facilities Project" certified March 1, 2001 prepared by Crawford, Multari, & Clark Associates.

"WWTF Drainage Report" for the Los Osos Community Services District dated April 22, 2002 prepared by MWH Americas, Inc. and Engineering Development Associates (EDA).

"Nitrate Monitoring Program Design" for the Los Osos Community Services District dated February 2002 prepared by Cleath & Associates.

"Urban Water Management Plan" for the Los Osos Community Services District dated December 2000 prepared by John L. Wallace & Associates and Maddaus Water Management.

"Water Master Plan" for the Los Osos Community Services District dated June 2001 prepared by John L. Wallace & Associates in association with Cleath & Associates.

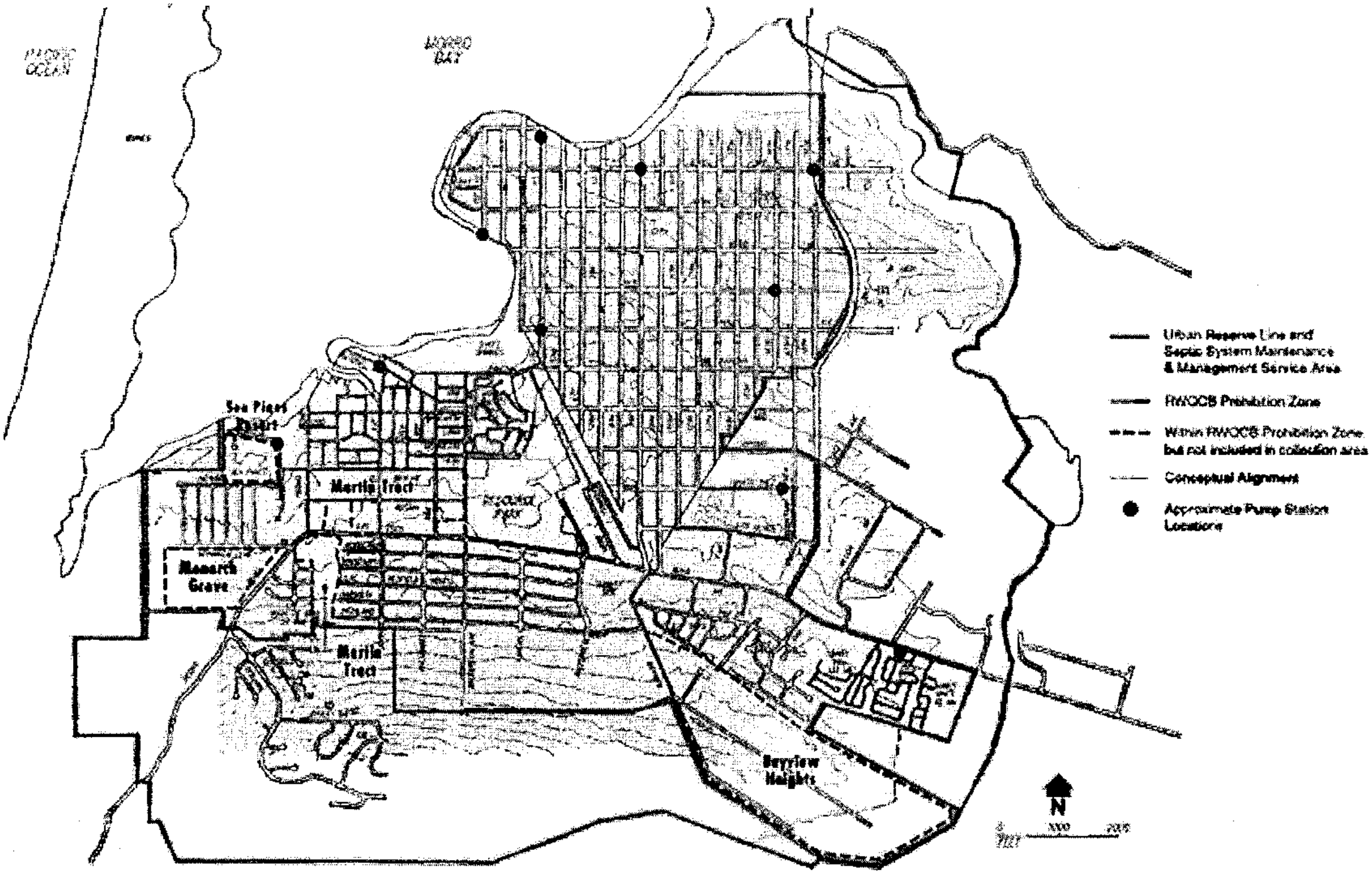


Figure 2 - Collection System

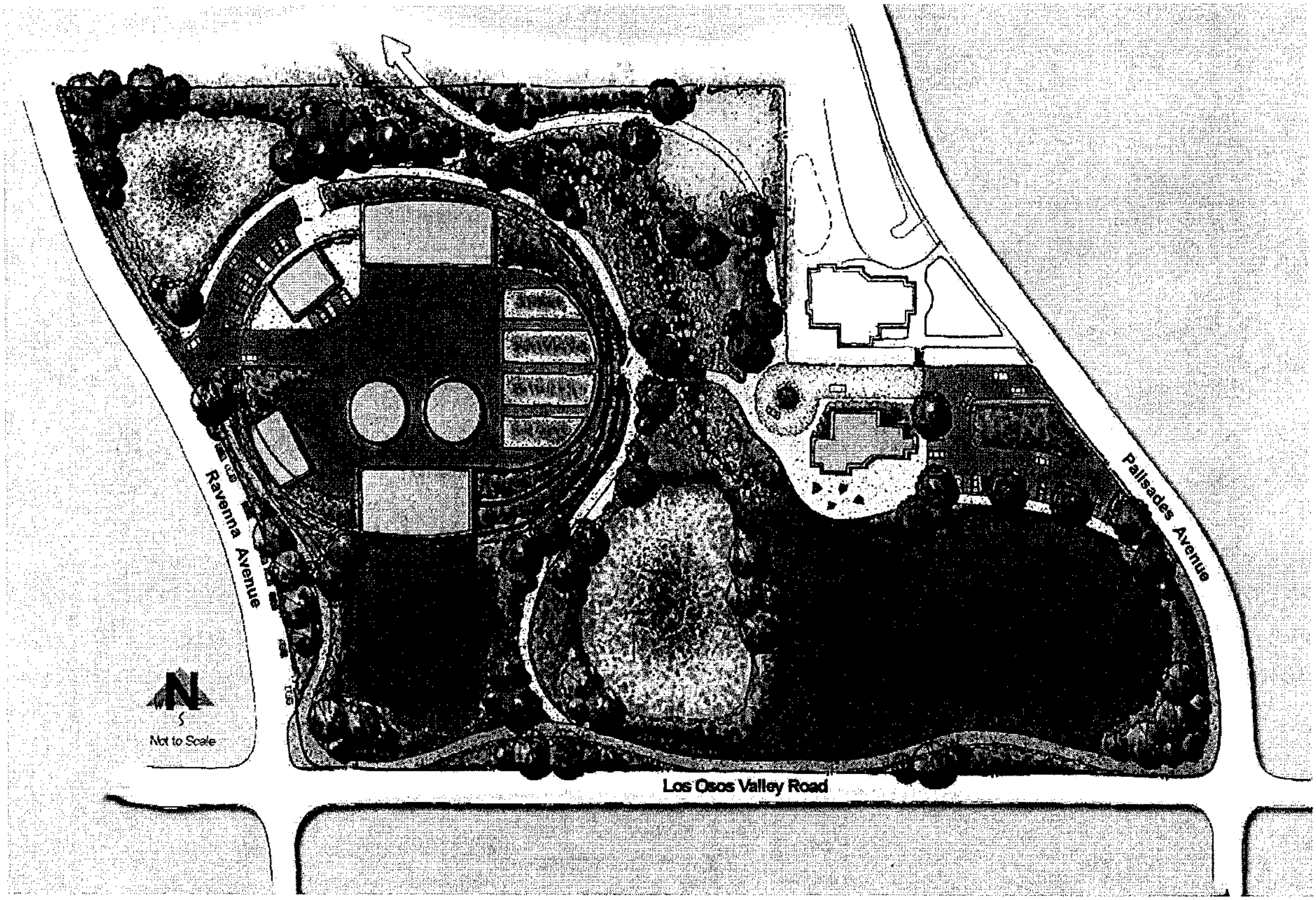


Figure 3 - Conceptual Site Plan

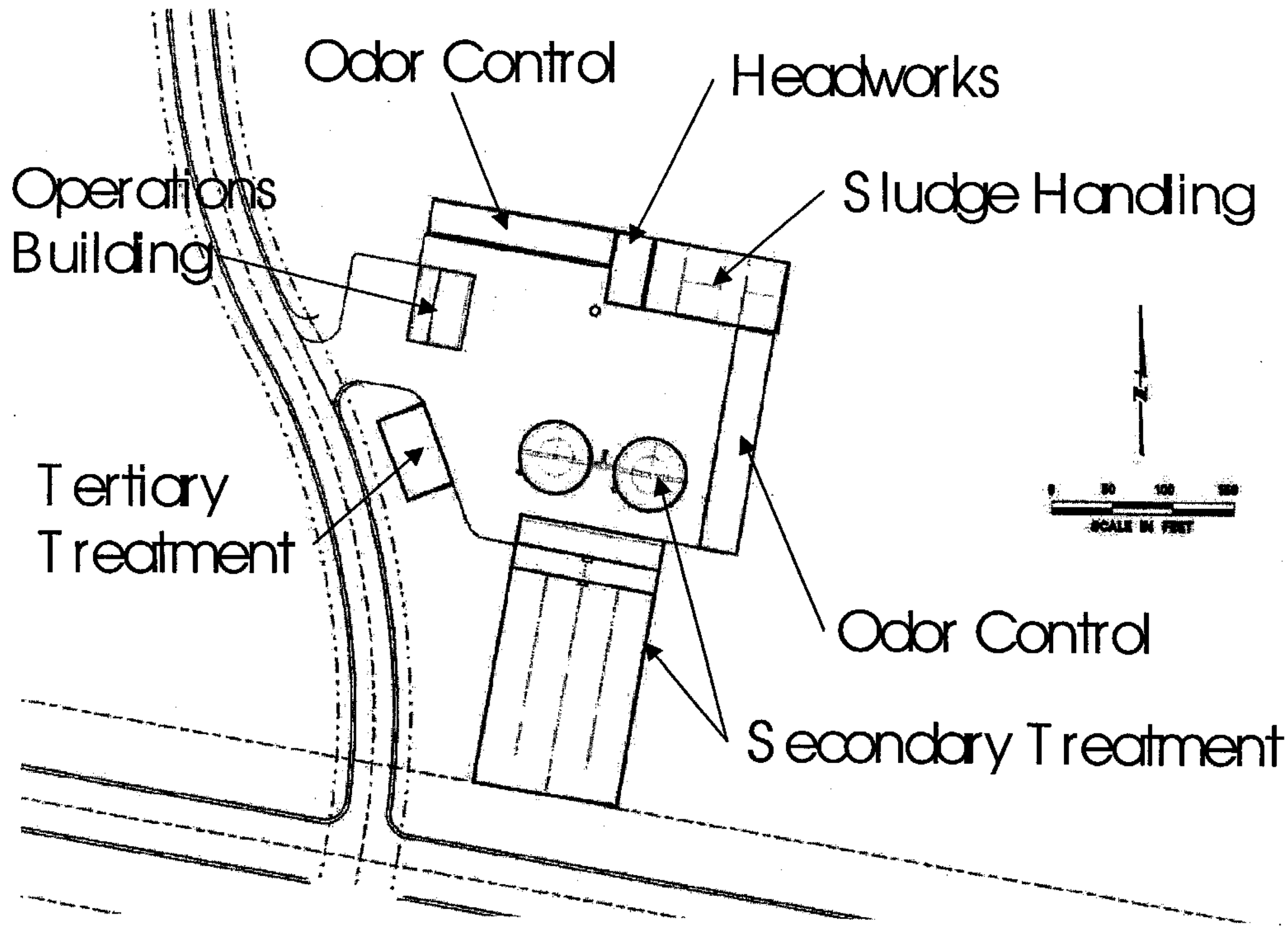


Figure 4 - Site Layout

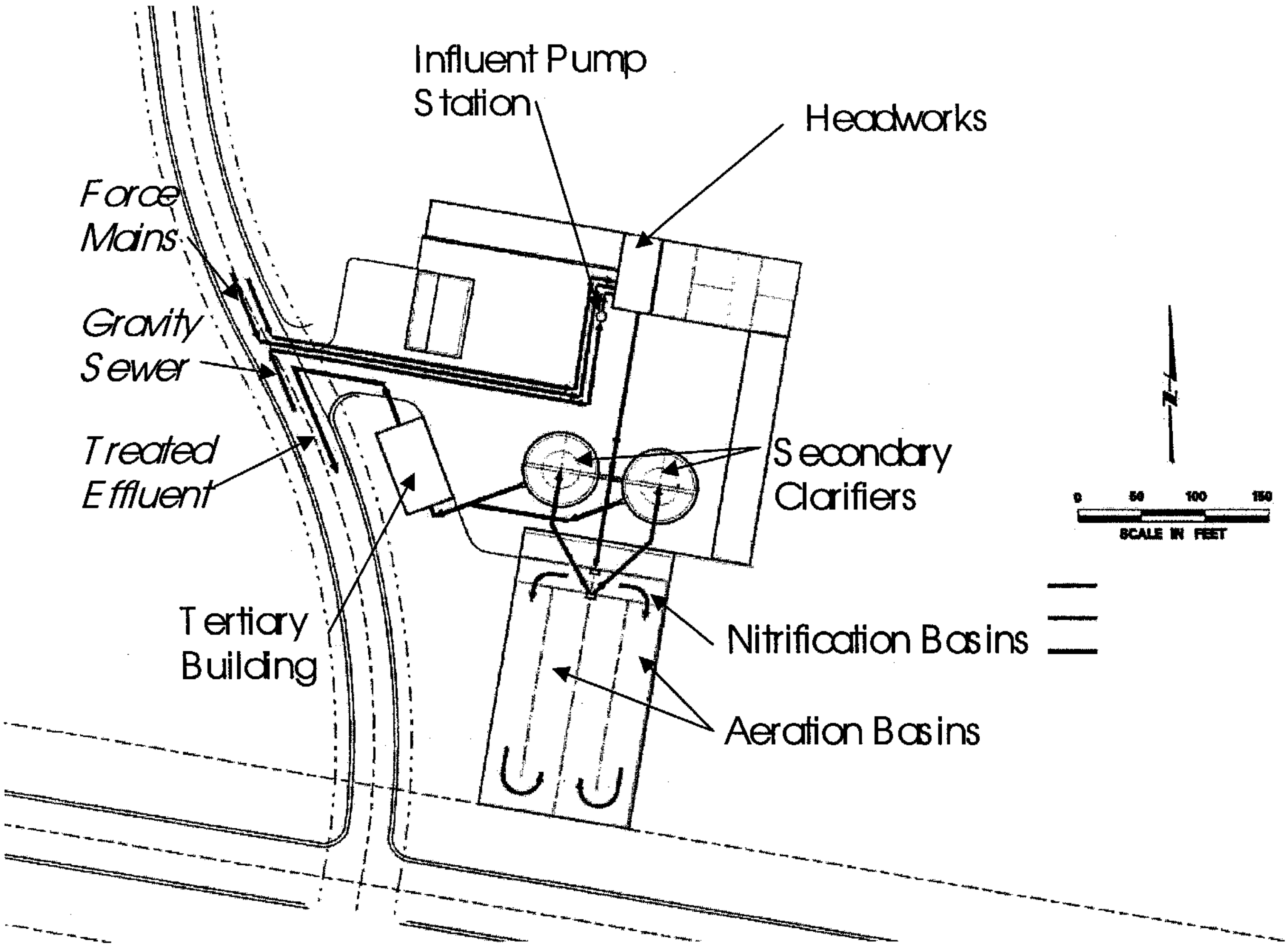


Figure 5 - Flow Schematic

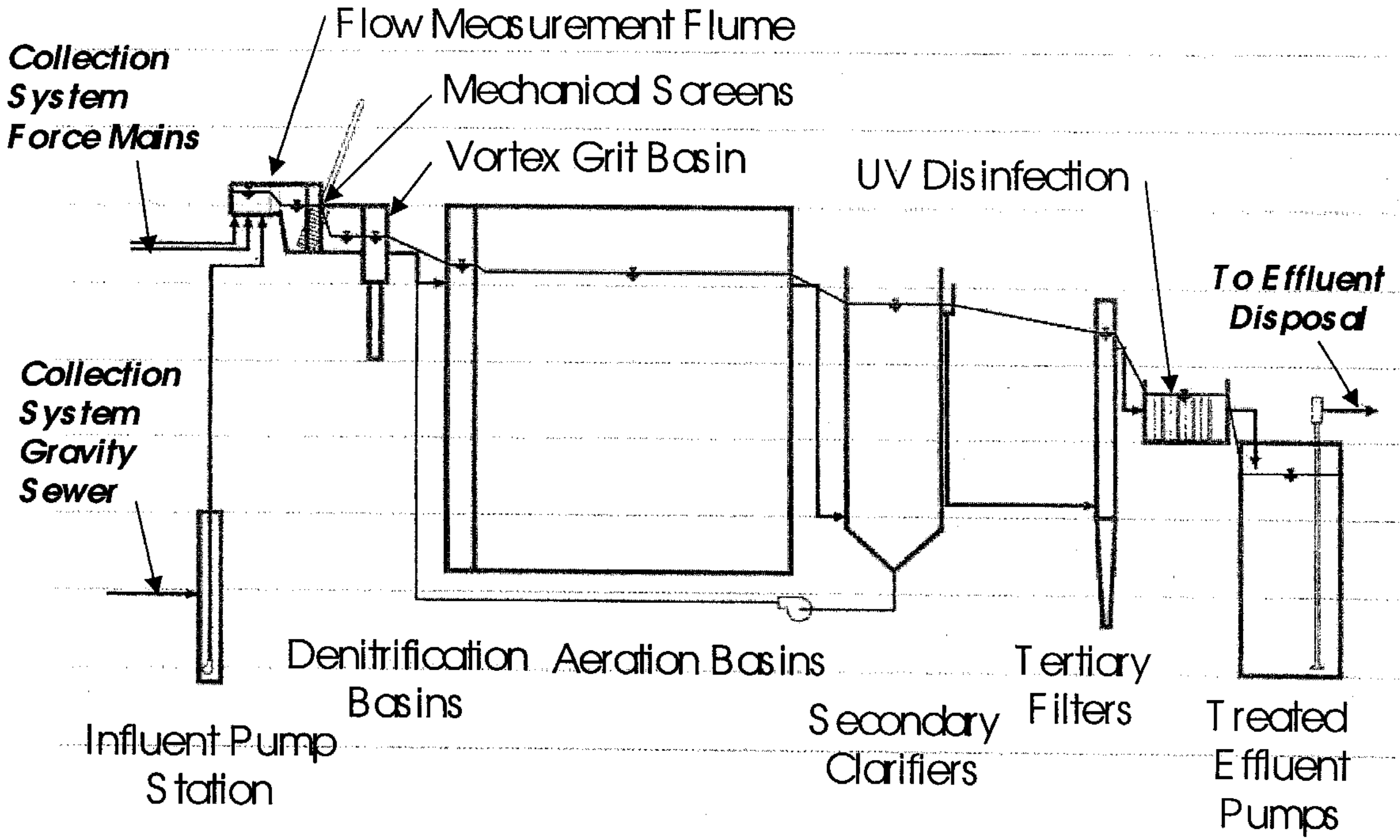


Figure 6 - Hydraulic Profile

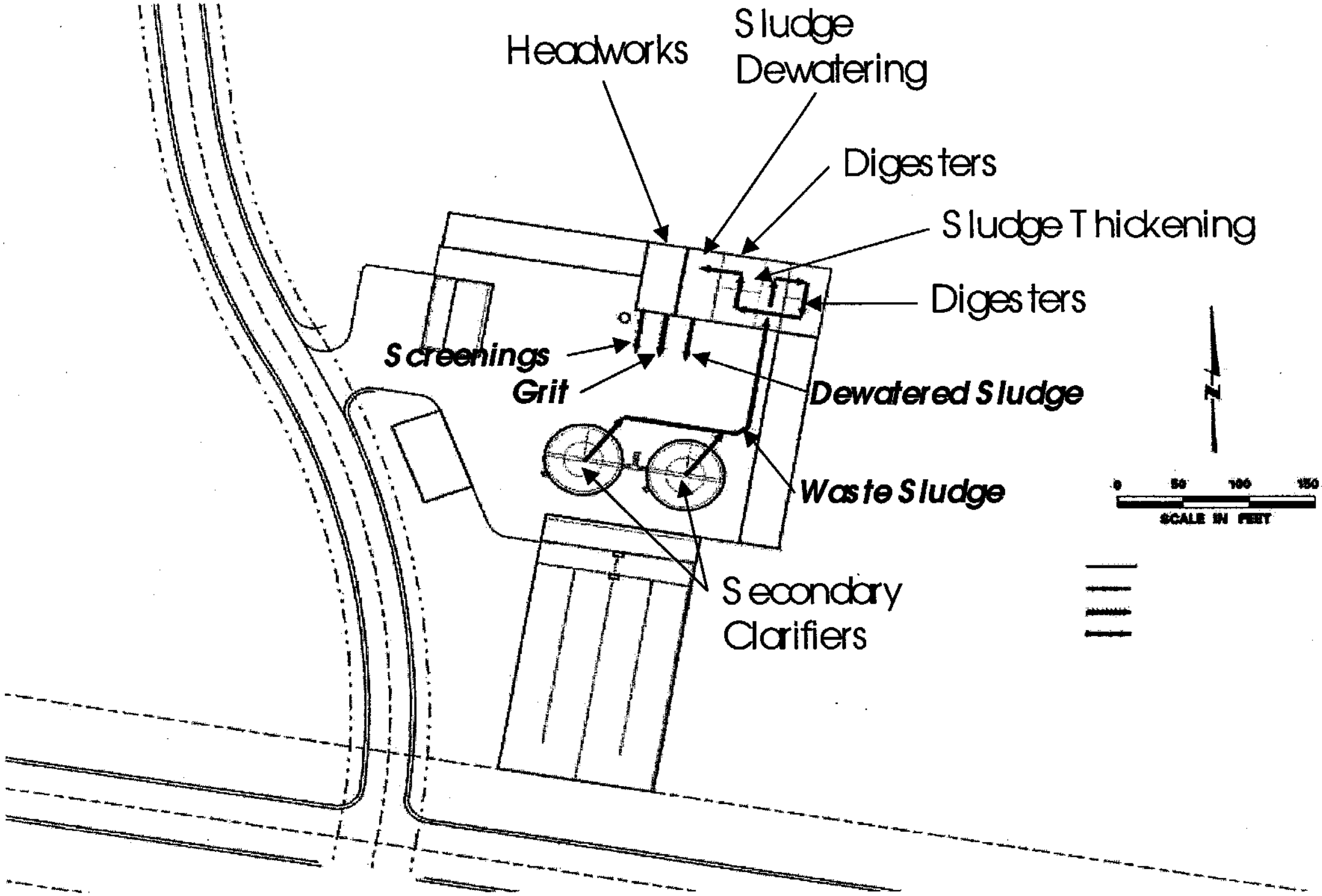


Figure 7 - Residuals Schematic

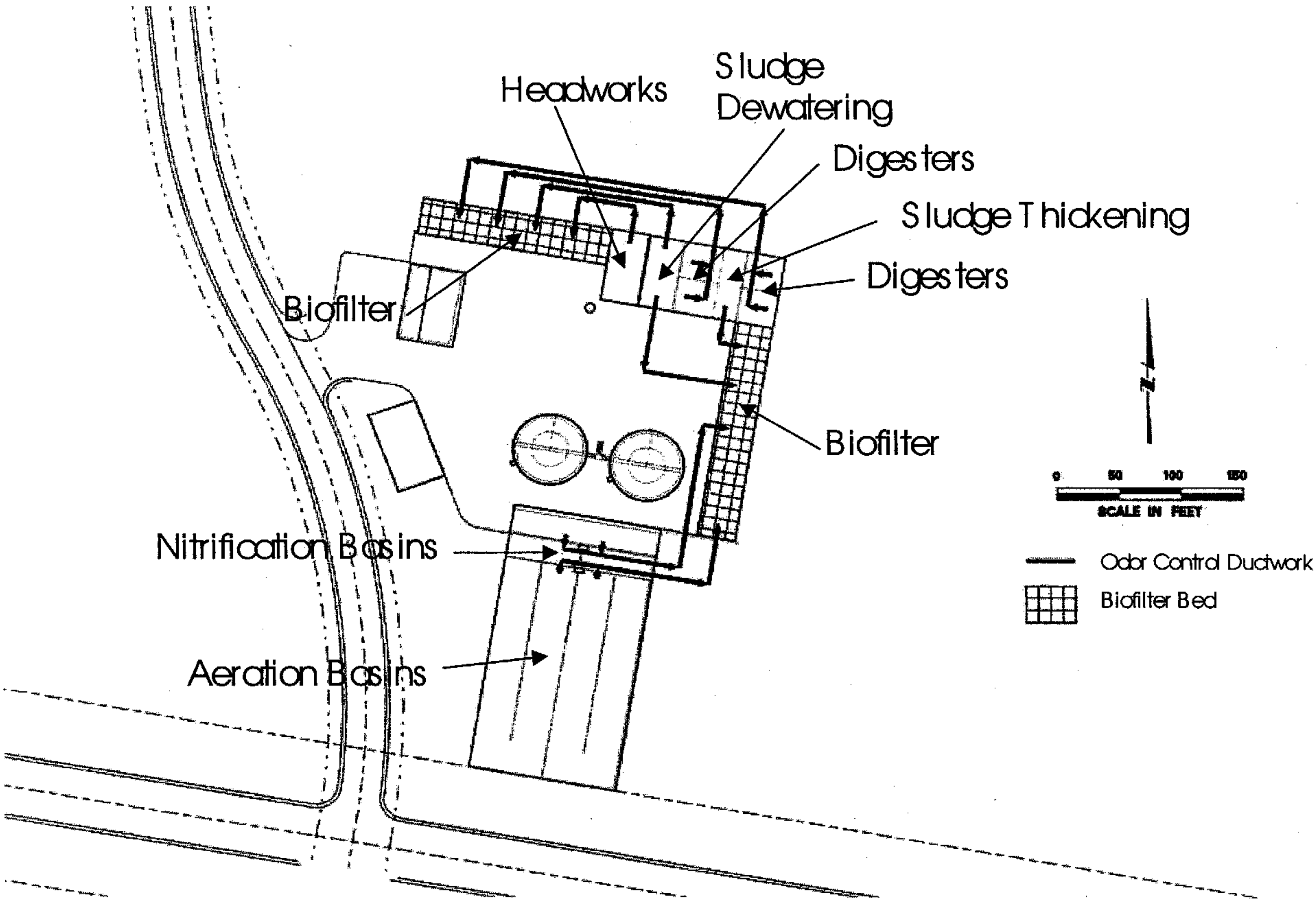


Figure 8 - Odor Control Schematic

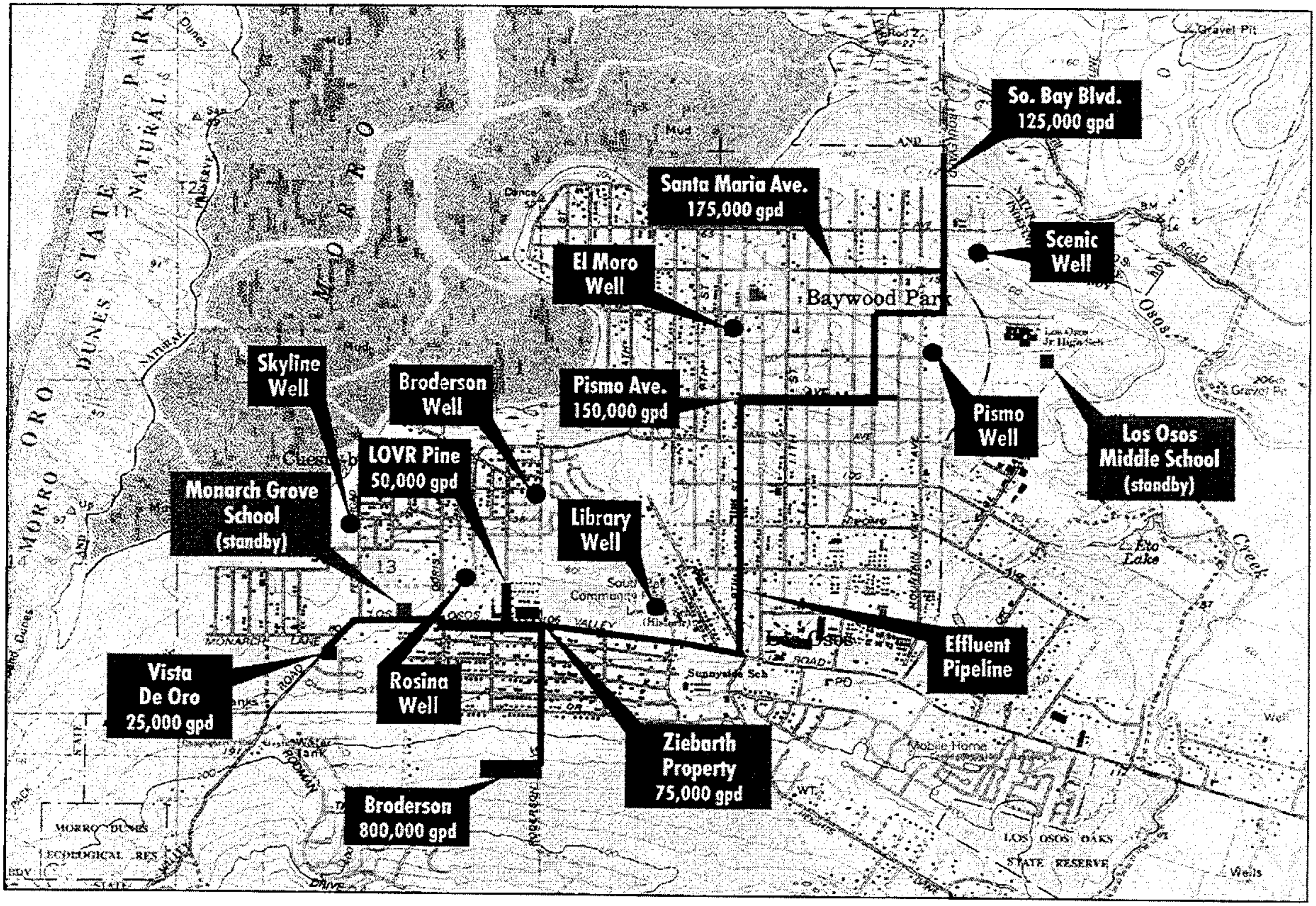


Figure 9 - Leachfield and Harvest Well Locations

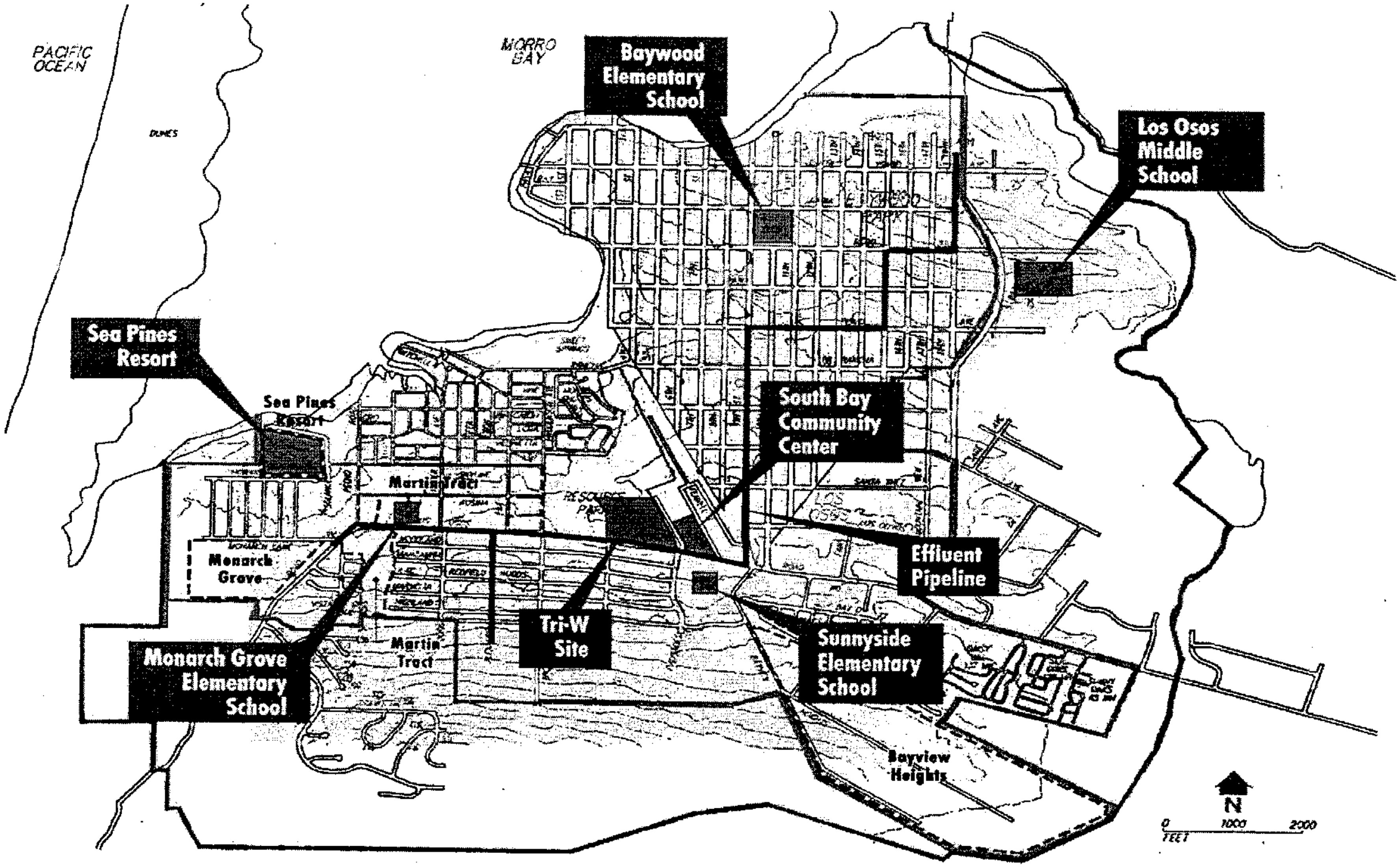


Figure 10 - Potential Reclaimed Water Locations

REPORT OF WASTE DISCHARGE

FOR THE

LOS OSOS WASTEWATER PROJECT

ATTACHMENTS

(ENDORSED)
FILED

MAR 1 6 2001

JULIE L. RODEWALD, COUNTY CLERK
By C.L. ELANDER
DEPUTY CLERK

NOTICE OF DETERMINATION

To: Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, California 95814

County Clerk
San Luis Obispo County

From: Los Osos Community Services District
2122 9th Street
Los Osos, CA 93402

Subject:	Notice of Determination in accordance with Section 21108 or 21152 of the Public Resources Code.
Project Title:	Los Osos Wastewater Facilities Project
State Clearinghouse Number:	9911103
Lead Agency Contact Person:	Bruce Buel, General Manager
Telephone No.:	(805) 528-9370
Project Location:	Los Osos California, San Luis Obispo County
Project Description:	Wastewater collection, treatment and disposal system for a coastal community with a 2001 population of 14,600 residents.

This is to advise that the ■ Lead Agency ☐ Responsible Agency has approved the above described project and has made the following determinations regarding the above described project.

1. The project ■ will ☐ will not have a significant effect on the environment.
2. An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures ■ were ☐ were not made a condition of the approval of the project.
4. A statement of Overriding Considerations ■ was ☐ was not adopted for this project.

This is to certify that the Final Environmental Impact Report with comments and responses and record of project approval is available to the General Public at:

Los Osos Community Services District
2122 9th Street
Los Osos, CA 93402

Bruce Buel | 3/15/01 | General Manager

Signature | Date | Title

Date received for filing and posting at OPR:

NITRATE MONITORING PROGRAM DESIGN

Prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

REGISTERED GEOLOGIST
SPENCER J. HARRIS
No. HG 63
CERTIFIED HYDROGEOLOGIST
STATE OF CALIFORNIA

February 2002

CLEATH & ASSOCIATES
1390 Oceanaire Drive
San Luis Obispo, California 93405

(805) 543-1413

TABLE OF CONTENTS

INTRODUCTION

The purpose of the Los Osos nitrate monitoring program is to evaluate upper aquifer salt loading in the Los Osos ground water basin. Salt loading is the accumulation of dissolved mineral salts (including nitrate) in ground water over time, typically due to anthropogenic factors. Excessive salt loading can lead to restrictions for both domestic and agricultural water uses. The monitoring program involves the periodic collection and analysis of water samples from a network of shallow wells, analysis for mineral salt concentration, and identification of changes in constituent concentrations over time.

The information obtained from the monitoring program will be useful to water purveyors and public agencies in assessing the status of water quality in the upper aquifer, and through the identification of water quality trends, in planning long-term basin management strategies. The program is also intended to satisfy monitoring requirements for future wastewater discharge associated with the community wastewater project, and will benefit studies on ground water recharge and movement.

There are three aspects to the monitoring program: data collection, sampling protocol, and data reporting. Data collection includes the type of water quality data collected, the frequency of collection, and the well locations recommended in the monitoring network. Sampling protocol covers sampling equipment and procedures. Data reporting includes presentation and interpretation of results.

BACKGROUND

Water quality monitoring in Los Osos has historically been performed by water purveyors, by permitted waste dischargers, and by various consultants and public agencies. In the early 1980's, Brown & Caldwell Consulting Engineers reviewed historical water quality data for the Los Osos ground water basin and determined that the existing data was inadequate for effective identification and documentation of water quality problems. A comprehensive ground water, surface water, and wastewater field sampling program was implemented, with the collection and analysis of 40 groundwater samples, two surface water samples, and six wastewater samples. Results of the basin-wide sampling event were interpreted and published in April 1983 (B&C, Phase I Water Quality Management Study).

Following the Brown & Caldwell study, the San Luis Obispo County Engineering Department began to monitor water quality at 18 ground water wells and four surface water locations. Sampling intervals were typically quarterly or semi-annual, although no samples were collected in1985 or 1986. Eleven of the 18 sampling locations were monitored by the County through the fourth quarter of 1998. Water quality analyses included general mineral and general physical parameters, including nitrate.

Nitrate has been the focus of water quality studies over the last decade. Basin-wide reviews of nitrate concentrations include the October 1994 Metcalf & Eddy Report (Los Osos Wastewater Study Report on Sanitary Survey and Nitrate Source Study) and the December 1995 Regional Water Quality Control

Board study (Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region).

BASIN GEOMETRY

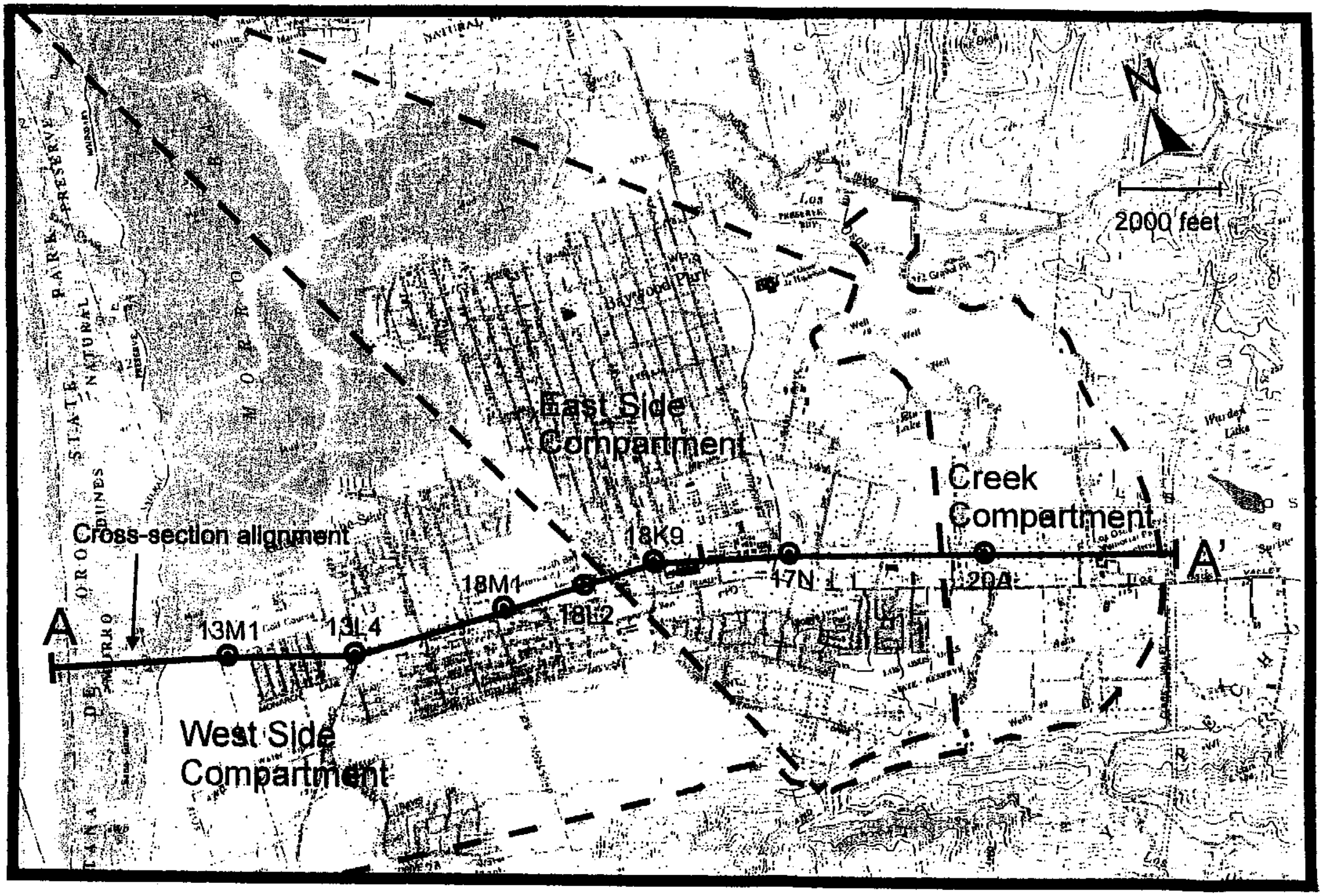
The outline of the Los Osos ground water basin is shown in Figure 1. The basin is bounded by non-water bearing rocks on the north, east, and south. On the west, the basin is bounded by the sea water/fresh water interface. The structure of the basin is roughly a synclinal trough, with an east west axis that is plunging to the west. Dip slopes at the edges of the basin reach approximately 4 degrees (7 percent). The basin is bisected by an inferred southeast-northwest trending fault splay associated with the Los Osos fault zone. Sediments forming the basin include dune sands, the Paso Robles Formation, and the Careaga Formation.

For the purpose of monitoring program design, the Los Osos ground water basin may been divided into three vertically discrete hydrogeologic zones; 1) first water (may include perched zone), 2) upper aquifer (shallow zone), and 3) lower aquifer (middle and deep zones). The basin also is comprised of three compartments; 1) West side, 2) East side, and 3) Los Osos Creek. A brief discussion of these zones and their relationship between compartments is presented below, and shown graphically in Figure 1 and in basin cross-section A-A' (Figure 2).

First water refers to the shallowest saturated horizon and corresponds to the water table. This zone is routinely monitored as part of a wastewater discharge permit, and was the primary focus of the historical 1982-1998 County monitoring program. First water is the interface where percolating waters, including precipitation and return flows from irrigation and wastewater, mix with basin waters. First water extends across all three basin compartments, and may be present in dune sands, Paso Robles Formation deposits, or Los Osos Creek alluvium. In downtown Los Osos, first water is perched above shallow clay horizons (AT1 Clay).

The upper aquifer, or shallow zone, refers herein to non-perched, water-bearing zones above the regional aquitard (AT2 Clay). On the West side (west of the inferred Sweet Springs splay of the Los Osos fault), the upper aquifer extends from first water to the AT2 Clay. In downtown Los Osos (East side compartment), the upper aquifer consists of Paso Robles Formation deposits beneath the perching clay. As the basin structure rises to the north along the limb of the regional syncline, the perching clay subcrops beneath relatively flat-lying dune sands and the upper aquifer becomes a water table aquifer (in Baywood Park), saturating both dunes sands and Paso Robles Formation deposits.

The lower aquifer refers to water bearing zones below the regional aquitard (AT2 Clay). There are both Paso Robles Formation and Careaga Formation deposits in the lower aquifer. The base of the lower aquifer is claystone and sandstone bedrock of the Pismo and Franciscan Formations, although the effective base of fresh water lies above bedrock at the western edge of the basin. The rising axis of the regional syncline is interpreted to cause the regional aquitard to crop out along the west banks of Los



Base map: USGS Topographic Map, Morro Bay South, 1994

Map Scale: 1 inch = 1,000 feet

Well location

Figure 1

Basin Compartments
Los Osos CSD

Cleath & Associates

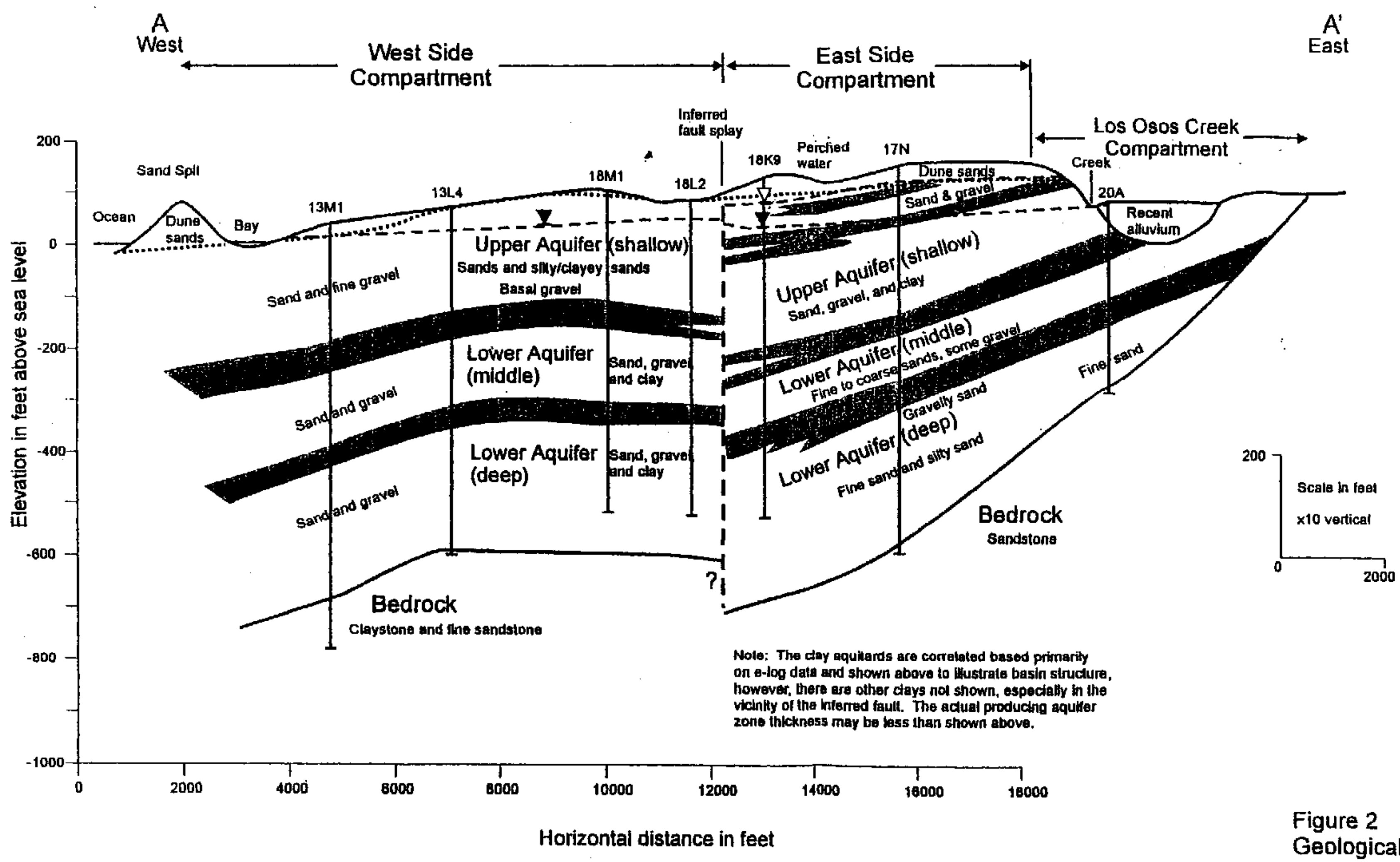


Figure 2
Geological Cross-Section A-A'
Generalized Basin Structure

Cleath & Associates

Osos Creek, and brings the lower aquifer in contact with the Los Osos Creek alluvium. There are two generalized aquifer zones within the lower aquifer. The middle zone lies between the AT2 and the AT3 Clays. The deep zone is below the AT3 clay (Figure 2).

DATA COLLECTION

Constituents

The proposed program will monitor salt loading in the upper aquifer of the Los Osos ground water basin. The optimal constituents list for salt loading monitoring is given below. The underlined constituents are the minimum recommended for the monitoring program by the Regional Water Quality Control Board.

Mineral salt constituents:

- Calcium
- Magnesium
- <u>Sodium</u>
- Potassium
- Alkalinity (Carbonate and Bicarbonate)
- <u>Sulfate</u>
- <u>Chloride</u>
- <u>Boron</u>
- <u>Total Nitrogen (all forms identified)</u>

Other:

- <u>Total dissolved solids (TDS)</u>
- Electrical Conductance (EC)
- pH
- Temperature

TDS and EC are standard measures for ground water mineralization and salinity. Temperature and pH are parameters that are routinely measured during sampling to verify that the ground water samples represent the actual aquifer conditions. Depth to water will also be measured prior to sampling.

Monitoring Frequency

Monitoring frequency is the time interval between sampling events. Seasonal fluctuations relating to ground water are typically semi-annual. The dry and wet periods of the year influence recharge, water levels, well production, and water quality. A semi-annual monitoring frequency would provide a measure of major seasonal cycles, which would then be distinguishable from long-term trends. The preferred sampling times would coincide with the seasonal water level fluctuations, typically late fall (low) and late spring (high).

It is not necessary to analyze all the above-listed constituents during every semi-annual sampling event. At a minimum, the bolded constituents required for wastewater discharge monitoring should be analyzed each time, along with the three field analyses (EC, pH, and temperature). The full general mineral suite may be performed once every two to five years, depending on the variation seen in the continuously monitored constituents. If little to no changes are seen in the continuously monitored constituents, then there is no reason to repeat the general minerals more than once every five years. If water quality is changing significantly over time, however, it is important to understand as much as possible about the process, and a complete general mineral analysis may be helpful in tracking ground water movement and estimating percentages of mixing between different waters.

Monitoring Locations

The Los Osos nitrate monitoring program will evaluate both first water and upper aquifer ground water quality. A distinction between monitoring first water quality and monitoring the upper aquifer quality in Los Osos is necessary. For practical purposes, it is the overall upper aquifer quality, rather than the quality of first water, that is most relevant to community water supply purveyors and to ground water basin management issues. On the other hand, historical water quality monitoring in Los Osos by the County has been mostly limited to wells in the shallowest portion of the upper aquifer. In order to continue evaluating historical water quality trends, these shallow (first water) wells must be used. Ground water sampling at lower aquifer wells is not part of this monitoring program. Water quality in the lower aquifer is already being monitored by community water supply purveyors. Available water purveyor data on lower aquifer water quality will be incorporated into the nitrate monitoring program reports.

First water, as mentioned previously, is routinely monitored as part of a wastewater discharge permit, and was the primary focus of the historical 1982-1998 County monitoring program. First water is the interface where percolating waters, including precipitation and return flows from irrigation and wastewater, mix with basin waters.

To provide continuity with prior water quality monitoring efforts, most of the wells in the 1982-1998 County program should be retained. Sample location continuity is an important aspect of monitoring, because it allows monitoring changes in water quality over time. Concerns with the wellhead seals must be addressed, however. At least 11 of the monitoring locations will require wellhead reconditioning, including installation of water-tight, traffic-rated well boxes with locking caps, a surface sanitary seal which is in contact with the well casing, and a cement apron to hold the well box that is tapered to drain away from the well. Prior to any such work, an application for well reconditioning should be submitted to the County Environmental Health Division for continued use as monitoring wells.

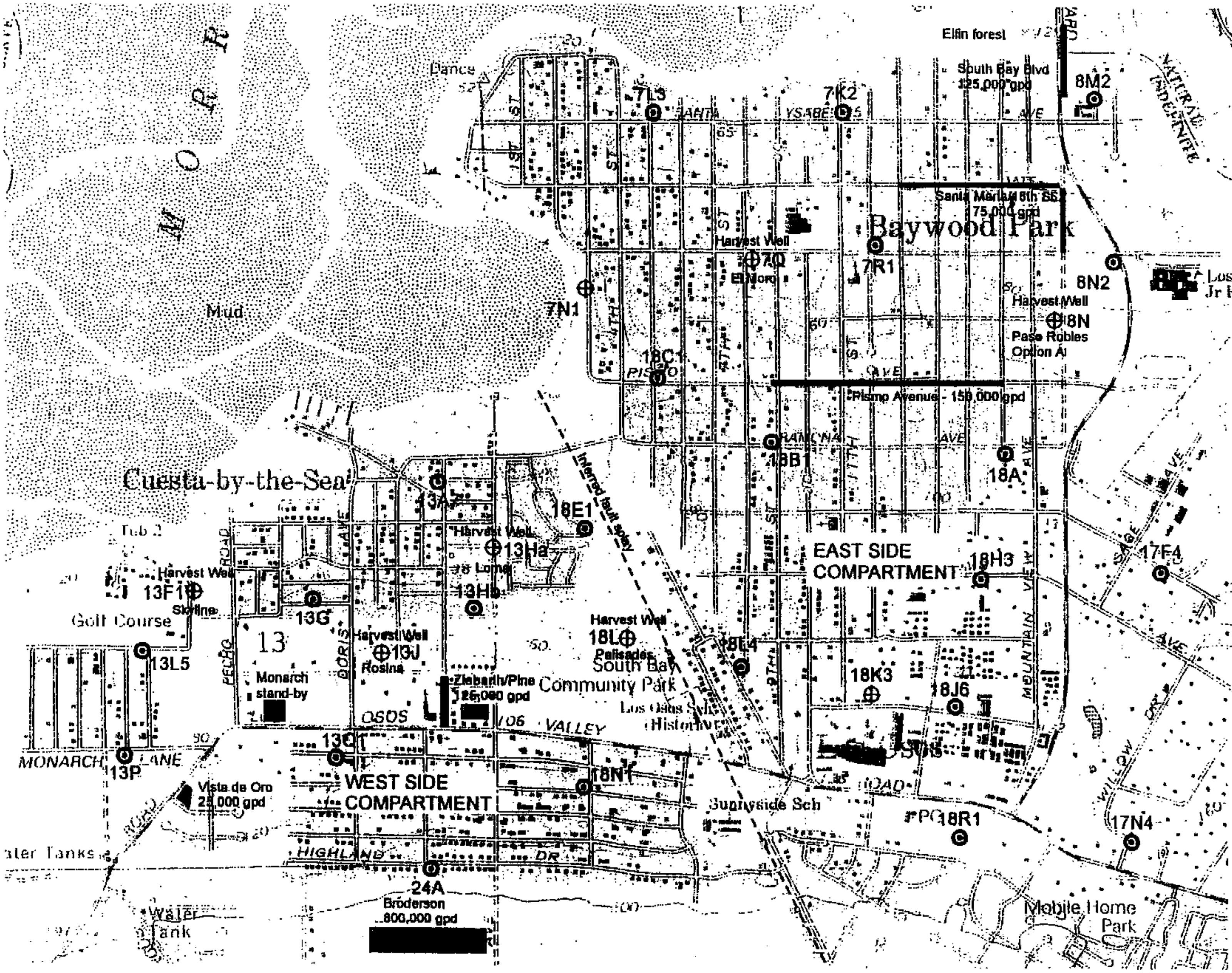
A total of 33 sampling locations are recommended across basin, including the East side, West side, and Creek compartments. All sampling location tap either first water or the upper aquifer. A summary of the locations are presented below in Table 1, and shown in Figures 3 and 4.

Table 1
Monitoring Well Locations - Nitrate Monitoring Program

Well ID	Location	Type	Depth (ft)	Perforated interval (ft)	Well diam. (in)	GSE (ft)	DTW approx. (ft)	Data history (years)
30S/10E								
13A7	Pine St.	Private	40	30-40	8	11.6	5	1982-1998
13F1	Solano/ Skyline	CCW	195	90-195	14	16*	10	1991-2001
13G	South Court	CSD mon	52	47-52	2	55*	40	none
13Ha	**Loma St.**	**CSD**	**190**	**90-190**	**10**	**50***	**20**	**none**
13Hb	Broderson/Skyline	CSD mon	34	29-34	2	55*	20	none
13J	**Rosina Ave.**	**CCW**	**190**	**90-190**	**10**	**85***	**55**	**none**
13L5	Howard/ Del Norte	CSD mon	35	32-35	1.5	29.98	20	1982-1998
13P	Monarch Lane	CSD mon	69	64-69	2	70*	60	none
13Q1	Woodland Dr.	CSD mon	100	97-100	1.5	98.61	80	1982-1998
24A	Highland/ Alexander	CSD mon	164	154-164	2	185*	150	none
30S/11E								
7K2	Santa Ysabel/ 12th	CSD mon	65	62-65	1.5	92.8	50	1982
7L3	Santa Ysabel/ 5th	CSD mon	45	43-45	1.5	43.32	35	1982-1998
7N1	3rd St.	CSD prod	83	61-71, 73-83	8	9.13	5	1982-2001
7Q	**El Moro/ 8th St.**	**CSD**	**125**	**75-125**	**10**	**25***	**5**	**none**
7R1	El Moro/ 12th St.	CSD mon	30	27-30	1.5	58.75	20	1982-1987
8N	**Paso Robles/ 18th**	**CSD**	**120**	**60-120**	**8**	**75***	**5**	**none**
8M2	SantaYsabel east	Private	90	70-90	6	100*	50	none
8N2	El Moro/ 12th St.	CSD mon	45	42-45	1.5	97.75	30	1982
17F4	Hollister Ln.	Private	72	48-72	8	76.2	40	1983-1998
17N4	Willow Dr.	Private	60	40-60	6	160.2	10	1983-1987
18A	Ramona Ave./16th St.	Private	tbd	tbd	tbd	100*	40	tbd
18B1	Ramona Ave./10th St.	CSD mon	32	29-32	1.5	76.97	15	1982-1987
18C1	Pismo Ave./ 5th St.	CSD mon	30	27-30	1.5	30.6	20	1982
18E1	Morro Shores	CSD mon	60	40-60	6	37.5	25	1982
18H3	Nipomo Ave.	Private	110	50-100	6	107.56	60	1982
18J6	Los Olivos/ Fairchild	CSD mon	25	22-25	1.5	122.65	15	1982-1998
18K3	Los Olivos/11th St.	CCW prod	232	148-202/222-232	8	121.2	115	1982-2001
18L	**Palisades Ave.**	**CSD**	**190**	**90-190**	**10**	**85***	**30**	**none**
18L4	Ferrell Ave.	CSD mon	25	22-25	1.5	101.13	15	1982
18N1	Manzanita/ Ravenna	CSD mon	90	87-90	1.5	106.82	80	1982-1987
18R1	Los Osos Valley Rd.	Private	50	40-50	8	168.64	10	1982-1999
20B	Palomino Drive	Private	tbd	tbd	tbd	100*	60	tbd
21D13	Tapidero Street	Private	100	35-100	tbd	70*	35	1984, 1987

Notes: Wells in bold are not yet constructed (future harvest wells)
DTW = depth to water (approximate - various dates)
Data history = years with available water quality data
* Estimated elevations (survey needed)

GSE = ground surface elevation
CCW = California Cities Water
CSD = Los Osos CSD
tbd = to be determined



Base map: USGS Topographic Map, Morro Bay South
Map Scale: 1 inch = 1,000 feet

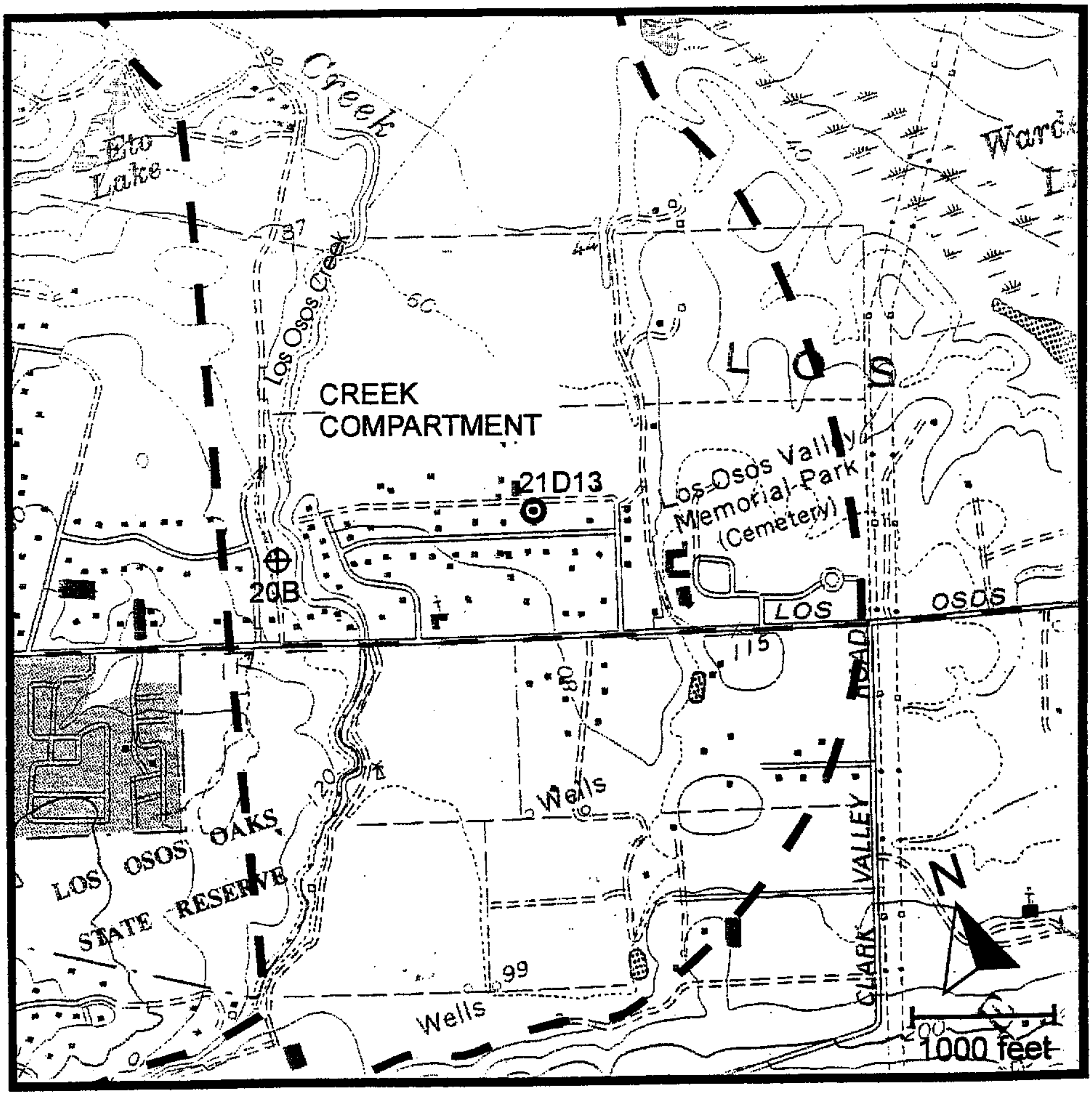
⊕ Upper aquifer monitoring location

⊙ First water monitoring location

Figure 3

East Side and West Side
Monitoring Well Locations
Los Osos CSD

Cleath & Associates



Base map: USGS Topographic Map, Morro Bay South, 1994

Map Scale: 1 inch = 1,000 feet

⊕ Upper aquifer monitoring location

⊙ First water monitoring location

— — — Compartment boundary

Figure 4

Creek Compartment
Monitoring Well Locations
Los Osos CSD

Wells recommended for inclusion in the new monitoring program are discussed individually below. The rationale for including wells in the monitoring program may include continuity with historical monitoring locations, improved lateral coverage of the basin, and assisting basin management operations (identifying water quality trends at harvest wells and for solute transport model calibration).

30S/10E-13A7

Pine Street. Private well; equipped. NO3-N concentrations ranges from 6.5 to 17.2 mg/l, average 11 mg/l (1982-1998). Mostly in excess of drinking water standards since 1989. This is a shallow residential well (first water). Recommended to provide continuity with historical nitrate monitoring program data.

HW **30S/10E-13F1**

Solano Street near Skyline. California Cities Water (CCW) production well; equipped. Well is presently inactive, but has been selected for harvest well service. NO3-N concentration measured 18 mg/l in January 2001. This is an upper aquifer well. Recommended due to harvest well status and for solute transport model calibration.

30S/10E-13G

South Court. Former Metcalf & Eddy monitoring well. Well taps first water. No history of water quality. Recommended due to location, which will assist in coverage of west side. Also allows comparison of first water quality to upper aquifer quality in the vicinity of harvest wells.

HW **30S/10E-13Ha**

Loma Street (east end). Future Los Osos CSD harvest well site; will be equipped. Will be an upper aquifer well. Recommended due to harvest well status and for solute transport model calibration.

30S/10E-13Hb

Broderson Avenue at Skyline Drive. Former Metcalf & Eddy monitoring well. Well taps first water. No history of water quality. Recommended due to location, which will assist in coverage of west side. Also allows comparison of first water quality to upper aquifer quality in the vicinity of harvest wells.

HW **30S/10E-13J**

Rosina Ave. Future CCW harvest well site; will be equipped. Will be an upper aquifer well. Recommended due to harvest well status and for solute transport model calibration.

30S/10E-13L5

Howard / Del Norte. Former Brown & Caldwell monitoring well. NO3-N concentrations ranges from 5.8 to 40 mg/l, average 19 mg/l (1982-1998). Mostly in excess of drinking water standards since 1984. This is a first water monitoring well. Recommended to provide continuity with historical nitrate monitoring program data. Wellhead improvements needed.

30S/10E-13P
Monarch Lane at El Dorado. Former Metcalf & Eddy monitoring well. Well taps first water. No history of water quality. Recommended due to location, which will assist in coverage of west side.

30S/10E-13Q1
Woodland Dr. Former Brown & Caldwell monitoring well. NO3-N concentrations ranges from 10.6 to 32 mg/l, with an average of 22 mg/l (1982-1998). Consistently in excess of drinking water standards since 1982. Trend of deteriorating water quality. This is a first water monitoring well. Recommended to provide continuity with historical nitrate monitoring program data. Wellhead improvements needed.

30S/10E-24A
Highland Ave. / Alexander (located on Broderson wastewater disposal site). Former Metcalf & Eddy monitoring well. Well taps first water. No history of water quality. Recommended due to location, which will assist in coverage of west side.

30S/11E-7K2
Santa Ysabel Ave. / 12th Street. Former Brown & Caldwell monitoring well. NO3-N concentration of 14.6 mg/l in June 1982 (in excess of drinking water standards). This is a first water monitoring well. Recommended due to location, which will assist in coverage of east side. Wellhead improvements needed.

30S/11E-7L3
Santa Ysabel / 5th Street. Former Brown & Caldwell monitoring well. NO3-N concentrations ranges from 4.3 to 20.5 mg/l, with an average of 14 mg/l (1982-1998). Consistently in excess of drinking water standards since 1987. This is a first water monitoring well. Recommended to provide continuity with historical nitrate monitoring program data. Wellhead improvements needed.

30S/11E-7N1
3rd Street. Los Osos CSD production well. NO3-N concentrations ranges from 1.5 to 5 mg/l, with an average of 2.7 mg/l (1982-1998). Consistently below drinking water standards. This is a partially-penetrating upper aquifer water supply well. Clay aquitard present from 30-56 feet depth. This locally confining clay is not laterally extensive, based on information at 8th Street and El Moro Avenue. Recommended to provide continuity with historical nitrate monitoring program data.

HW **30S/11E-7Q**
8th Street / El Moro (east end). Future Los Osos CSD harvest well site; will be equipped. Will be an upper aquifer well and will replace the old 8th Street Well (7Q1). NO3-N concentrations at 7Q1 ranged from 3.1 to 19 mg/l, with an average of 14 mg/l (1982-1998). Consistently in excess of drinking water standards since 1982. Recommended due to harvest well status, for solute transport model calibration, and to provide continuity for historical nitrate monitoring program data.

30S/11E-7R1
El Moro / 12th Street. Former Brown & Caldwell monitoring well. NO3-N concentration 19.7 mg/l in June 1982 (in excess of drinking water standards). This is a first water monitoring well. Recommended due to location, which will assist in coverage of east side. Wellhead improvements needed.

30S/11E-8M2
Santa Ysabel east of South Bay Boulevard. Private well. No water quality history. This is a first water well. Recommended due to location, which will assist in coverage of east side.

30S/11E-8N2
El Moro / South Bay Boulevard. Former Brown & Caldwell monitoring well. NO3-N concentration of 2.61 mg/l in June 1982 (below drinking water standards). This is a first water monitoring well. Recommended due to location, which will assist in coverage of east side. Wellhead improvements needed.

HWl **30S/11E-8N**
Paso Robles / 18th Street (Option A). Future Los Osos CSD harvest well site; will be equipped. Will be an upper aquifer well. Recommended due to harvest well status and for solute transport model calibration.

30S/11E-17F4
Hollister Lane. Private well; equipped. NO3-N concentrations ranged from not detected to 4.4 mg/l, with an average of 1.3 mg/l (1982-1998). Consistently below drinking water standards. This is a first water monitoring well. Recommended to provide continuity for historical nitrate monitoring program data.

30S/11E-17N4
Willow Drive. Private well; equipped. NO3-N concentrations ranged from 3.6 to 4.4 mg/l (1983-1987). Consistently below drinking water standards. This is a first water monitoring well. Recommended to provide continuity for historical nitrate monitoring program data.

30S/11E-18A
Ramona Ave. / 16th Street vicinity. Any private well in area (specific location not yet identified). Unknown water quality history. Will probably be a first water monitoring well. Recommended due to location, which will assist in coverage of east side.

30S/11E-18B1
Ramona Ave. / 10th Street. Former Brown & Caldwell monitoring well. NO3-N concentration ranged from 2.1 mg/l to 12.9 mg/l (last measured at 2.1 mg/l in 1987; below drinking water standards). This is a first water monitoring well. Recommended due to location, which will assist in coverage of east side. Wellhead improvements needed.

30S/11E-18C1
Pismo Ave. / 5th Street. Former Brown & Caldwell monitoring well. NO3-N concentration of 9.53 mg/l in June 1982; below drinking water standards. This is a first water monitoring well. Recommended due to location, which will assist in coverage of east side. Wellhead improvements needed.

30S/11E-18E1
Morro Shores mobile home park. Private well; equipped. NO3-N concentration of 3.47 mg/l in 1982 (below drinking water standards). This is a first water monitoring location. Recommended due to location, which will assist in coverage of east side.

30S/11E-18H3
Nipomo Avenue. Private well; equipped. NO3-N concentration of 15.9 mg/l in June 1982 (in excess of drinking water standards). This is a first water monitoring location. Recommended due to location, which will assist in coverage of east side.

30S/11E-18J6
Los Olivos / Fairchild. Former Brown & Caldwell monitoring well. NO3-N concentrations ranges from not detected to 21 mg/l, with an average of 3.4 mg/l (1982-1998). Mostly below drinking water standards (one exception). This well monitors a lense within the perched aquifer in downtown Los Osos. There is a separate perched water zone above the zone being monitored. Trend of water quality deterioration suggested by chloride concentrations over time. Recommended to provide continuity for historical nitrate monitoring program data. Wellhead improvements needed.

30S/11E-18K3
Los Olivos Ave near 11th Street. California Cities Water (CCW) production well; equipped. NO3-N concentrations consistently below drinking water standards. This is an upper aquifer well (beneath perched aquifer in downtown Los Osos). Recommended due to location for basin management operations (nitrate solute transport model calibration).

HW **30S/11E-18L**
Palisades Avenue (north end). Future Los Osos CSD harvest well site; will be equipped. Will be an upper aquifer well. Recommended due to harvest well status and for solute transport model calibration.

30S/11E-18L4
Ferrell Avenue. Former Brown & Caldwell monitoring well. NO3-N concentration of 10.5 mg/l in June 1982 (above drinking water standard). Recommended due to location, which will assist in coverage of east side. Wellhead improvements needed.

30S/11E-18N1
Manzanita / Ravenna. Former Brown & Caldwell monitoring well. NO3-N concentration 21.8 mg/l in June 1982 (above drinking water standard). Recommended due to location, which will assist in coverage of east side. Wellhead improvements needed.

30S/11E-18R1

Los Osos Valley Road (Bender - Garage). NO3-N concentrations ranges from 8.4 to 21 mg/l, average 16 mg/l (1982-1998). Mostly in excess of drinking water standards. Trend of deteriorating water quality through 1990. This is a first water monitoring well. Recommended to provide continuity for historical nitrate monitoring program data.

30S/11E-20B

Palomino Drive. Any private well in area that taps the upper aquifer (specific location not yet identified). Unknown water quality history. Recommended due to location, which will allow assessment of the upper aquifer flow between the East side and Creek compartments.

30S/11E-21D13

Tapidero Avenue. Private well. NO3-N concentrations ranged from 11.2 to 23 mg/l, average 17 mg/l (three samples in 1984 and two in 1987). Consistently in excess of drinking water standards. This is a first water monitoring well. Recommended to provide continuity for historical nitrate monitoring program data and due to location in Creek compartment.

SAMPLING PROTOCOL

The recommended sampling protocol, including the selection of equipment, is designed to allow one technician the ability to sample all the wells in the program. The sampling protocol is divided into two sections, sampling procedures and sampling equipment. An example field log sheet is attached.

Sampling Procedures

Sampling procedures for general mineral and nitrate sampling are presented below. The purpose of the procedures are to ensure that communication is established with the aquifer prior to sample collection.

Non-equipped monitoring wells (15 wells total):

1) Calibrate field monitoring instruments each day prior to sampling.
2) Inspect wellhead condition and note any maintenance required (perform at earliest convenience).
3) Measure depth to static water (record to 0.01 inches) from surveyed reference point.
4) Install temporary purge pump to at least three feet below the water surface (deeper setting may be needed if water level draw down is too great).
5) Begin well purge, record flow rate.
6) Measure discharge water EC (measured to 10 µmhos/cm), pH (measured to 0.01 units), and temperature (measured to 0.1 degrees F) twice during each casing volume purge. Record time and gallons purged. Allow sufficient time for any discharge water trapped in hose from prior well sampling event to be displaced before taking first measurement. Also note discharge water color, odor, and turbidity (visual).

7) A minimum of three casing volumes of water should be removed during purging. In addition, a set of at least three consecutive field monitoring measurements with stable values should be recorded. For EC, stability within 10 percent of the first value in the set is sufficient (typically within 50-100 µmhos/cm). For pH, stability within 5 percent of the first value is sufficient (typically within 0.3-0.4 units). For temperature, stability within 1 percent of the first value is sufficient (typically within 0.5-0.7 degrees).
8) Collect sample directly from discharge tube, note sample color, odor, turbidity (visual). Use only laboratory-provided containers.
9) Place samples on-ice for transport to the laboratory.
10) Remove temporary pump, dry off pump and wet portion of hose with clean towel (rinse first with clean water if sediment or foreign matter observed).
11) Close well and secure well box lid.

Equipped wells (18 wells total):

The sampling port for an equipped well must be upstream of any water filtration or chemical feeds. Sample from the discharge line as close to the wellhead as possible. Sampling procedures for equipped wells will vary, based on whether the well is active or inactive. For active wells (i.e. wells used daily), the need for purging three casing volumes is unnecessary. The well should be turned on for a nominal 5 minutes, and one set of EC, pH, and temperature readings collected prior to sampling. For inactive wells, a field monitoring procedure similar to that described above would be appropriate. Static water level measurements should also be taken before sampling. Water samples should always be transported on-ice to the laboratory.

Sampling Equipment

The recommended sampling equipment for non-equipped wells is a portable, reel-mounted downhole pump which would be transported from well to well. The main constraint for downhole pump choices is well diameter. There are 1.5-inch diameter and 2-inch diameter unequipped wells. A suitable pump choice would be the Bennett submersible piston pump, Model 140 (1.4-inches outside diameter). This pump is air-compressor powered, although air does not contact the discharged water. Purge rates of 1 gpm can be expected, which translates to purge times of less than 20 minutes for the unequipped wells. A compressor with minimum 80 psi pressure capacity and 3 cfm air flow capacity would be sufficient to drive the pump. The portable unit includes a manual, chain-driven reel with swivel head and hand-brake, built in water-level indicator, flow meter, and air pressure regulator and gage. Discharge tubing choices are polypropylene or teflon (polypropylene is acceptable for program application).

For sampling events conducted by Cleath & Associates, water level sounding and field water quality monitoring equipment are provided at no additional charge. Should a trained water purveyor technician perform the sampling program, however, these items would need to be purchased.

Accurate water level measurements are an important part of the sampling procedure. The water level indicator on the sampling pump reel should only be used for pump depth setting, not for reporting depth to water. For depth to water measurements, a calibrated well sounder is needed. Various brands are available. One suitable product is the Powers Well Sounder, with flexible 3/8-inch diameter brass weights at the probe and a 20 AWG size cable. The construction of this sounder is durable, and the flexible probe end minimizes the potential for getting hung up on other downhole equipment.

There are many field water quality monitoring meters available. Some offer EC, pH, and temperature in one meter, such as the Hydac tester. Any meter(s) capable of the resolutions recommended in the sampling procedures would be acceptable for the program.

DATA REPORTING

The data reporting should meet regulatory requirements and facilitate interpretation of trends. The following figures are recommended:

- A base map with sample locations.
- A water level contour map for estimating hydraulic gradients and flow directions.
- A nitrate concentration contour map for data from wells tapping first water, with upper aquifer well concentrations shown but not contoured. This will allow a comparison of the difference in quality between first water and the upper aquifer.
- A total dissolved solids concentration contour map for data from wells tapping first water, with upper aquifer well concentrations shown but not contoured (similar to nitrate map).
- A water level hydrograph and chemical hydrographs of nitrate and TDS at each well. A minimum of three historical data points should be available before a hydrograph is introduced.
- If the general mineral package is performed (first sampling event and every 5 years minimum), a trilinear diagram showing milliequivalent percentages for the major ions should be prepared.

In addition to the figures, the following tables are recommended:

- A table with well construction details and current water level information.
- A table summarizing water quality data for the latest sampling event.
- A table summarizing water quality from deep aquifer wells during the period (from water purveyors).

The report text should include the following items:

- A brief conduct of work and any unusual field observations or procedures during the sampling event.

- Discussion and interpretation of the results, including comparisons of the difference in quality between wells tapping first water and upper aquifer wells and identification of trends in water quality.
- Recommendations for any additions or modification to the nitrate monitoring program.

Laboratory results for the latest sampling event should be included as an appendix to each semi-annual report. All historical water quality data should be made available electronically for interested parties.

GROUND WATER MONITORING FIELD LOG
LOS OSOS NITRATE MONITORING PROGRAM

Date:____________________
Operator:________________
Well number and location:______________________________
Site and wellhead conditions:______________________________
____
____

Static water depth (feet): __________
Well depth (feet): __________
Water column (feet): __________
Casing diameter (inches): __________
Three casing volumes (gal): __________
Pump rate (gpm): __________
Pump setting (feet): __________
Minimum purge time (min): __________
Time begin purge: __________

Time	Gallons	EC	pH	Temp.	Comments*

* turbidity, color, odor, sheen, debris, etc.

MWH
MONTGOMERY WATSON HARZA

Los Osos Community Services District **April 22, 2002**
Los Osos Wastewater Project

Wastewater Treatment Facility
WWTF Drainage Report

Introduction

This Drainage Report for the Los Osos Wastewater Project updates and expands the Conceptual Drainage Report dated December 6, 2001. The Conceptual Drainage Report was transmitted to the Department of Public Works, San Luis Obispo County, on December 5, 2001.

This Drainage Report includes a document entitled "Drainage Study and Report for the Proposed Los Osos Wastewater Treatment Facility" dated April 5, 2002 prepared by Engineering Development Associates (EDA). The EDA report includes the hydrological routing analysis initially discussed at the December 5, 2001 meeting. The hydrological routing analysis utilizes methodology for infiltration ponds developed by King County, Washington. This methodology was used to size the proposed percolation basin for the off-site drainage tributary to the Wastewater Treatment Facility site.

Background

The Los Osos Community Services District (LOCSD) has obtained approval from regulatory agencies for the Project Report dated March 2001 prepared by Montgomery Watson Harza (MWH) and the Environmental Impact Report dated March 2001 prepared by Crawford, Multari, & Clark Associates (CMCA) for the Los Osos Wastewater Collection, Treatment, and Disposal System. The recommended project presented in the final Project Report includes a wastewater collection system including pump stations with standby power facilities, a wastewater treatment facility, and an effluent disposal system with harvesting wells.

The wastewater treatment facility (WWTF) will be located within Los Osos at the Tri-W site to the north of Los Osos Valley Road (LOVR) between Palisades Avenue and the future extension of Ravenna Avenue. The WWTF will be incorporated into a park setting in close proximity to the County Library, the South Bay Community Center, and future community facilities.

Two stormwater drainage issues will be addressed for the design of the WWTF. The first issue is the conventional need to address the on-site drainage that will be generated by the paving and structures associated with the WWTF. The second issue is the need to address the off-site drainage that currently enters the WWTF site from the drainage area south of LOVR.

On-Site Drainage

A retention basin located at the northwest corner of the WWTF site as shown on Figure 1 will handle the on-site drainage generated from the impervious improvements associated with the WWTF. The retention pond will be designed for a 50/10/10 (50 year / 10 hour time of concentration / 10 hour duration) storm event in accordance with SLO County requirements.

The retention pond will be provided with an overflow that will likely connect to the Morro Shores Development stormwater pipeline that will parallel the extension of Ravenna Avenue on the west side of the WWTF site.

Off-Site Drainage

Background. EDA has previously prepared a stormwater master plan for Los Osos entitled "Preliminary Drainage Evaluation, Los Osos / Baywood Park Community Drainage Project for San Luis County Service Area No. 9J" (EDA Study) dated February 27, 1997. The area tributary to the treatment facility site that contributes the off-site drainage is shown on Figure 2. The projected off-site drainage from these areas for different storm events is summarized in Table A.

Table A – Storm Event Parameters

Storm Event Interval	Peak Flow Rate
10-year	44 cfs
25-year	55 cfs
50-year	122 cfs
100-year	174 cfs

Under the current situation the off-site stormwater enters near the southeast corner of the WWTF site via a 30-inch diameter corrugated metal pipe culvert and follows a drainage course towards the center of the property. During large storm events the culvert surcharges and drainage will then also enter the site by overflowing across LOVR. At the center of the property the drainage course becomes less defined and widens out into the northwest corner of the WWTF site. The stormwater percolates rapidly into the soil and generally dissipates before the stormwater reaches the northwest corner of the property.

Existing Percolation Area. The area of percolation under the current situation as described above is analyzed in the attached EDA study. The percolation area was defined by a HEC analysis performed by EDA wherein the 100-year storm flow was assumed to enter the WWTF site at the drainage course and would diminish as the stormwater flowed towards the northwest corner of the WWTF site. Ten stations along the path of the drainage course were established and the stormwater was assumed to percolate by ten percent as each station was reached. The corresponding water surface elevation for the flow rate for a given station was determined and used to delineate the percolation area. The percolation area identified by this approach is approximately 78,000 sf or 1.8 acres.

Design Approach. The design intent of the wastewater project is to handle the off-site drainage in a manner that will duplicate the current situation. The design approach will provide the equivalent percolation area for the off-site drainage in the Tri-W site that will be regraded for the WWTF. This approach is intended to duplicate the percolation that is currently achieved on-site and thereby not introduce any additional stormwater downstream of the WWTF site.

The WWTF site will be regraded to accommodate an open play field for the future park adjacent to the treatment facility as shown on Figure 1. The play field will be designed to have 5:1 side slope and not to exceed a water depth of 2 feet in accordance with County requirements.

The proposed design approach for the off-site drainage will also incorporate a sedimentation basin as shown on Figure 1. The sedimentation basin will provide pretreatment to settle silt, sand, and fine material that may be conveyed by the off-site stormwater. The capture of silt and fine material in the sedimentation basin will prevent matting of the surface of the play field that could subsequently limit the rate of percolation.

Flow Management. All off-site drainage will be routed to the sedimentation basin. The sedimentation basin will be constructed with two weirs set at different elevations. Stormwater in excess of the sedimentation basin volume will overflow from the lowest weir to the percolation basin. When the water in the percolation basin reaches a depth of 2 feet, any flow in excess of the percolation basin capacity will overflow at the higher weir. This second overflow would be confined to an overflow conduit that will likely connect to the Morro Shores Development stormwater pipeline that parallels the extension of Ravenna Avenue on the west side of the WWTF site.

Sedimentation Basin. The sedimentation basin will be designed to capture 0.15-mm sand particles (native soil material) for a 25-year storm event. This level of pretreatment is projected to provide the equivalent capture of 0.02 mm silt particles for some flow rate between a 5-year to 10-year storm event. The sedimentation basin is projected to be approximately 11,000 sf with a nominal depth of 5 feet. The effective volume of the sedimentation basin is estimated to be 57,000 cf with allowance for the side slope of the basin and a reduced depth due to the accumulation of sand and silt at the bottom of the sedimentation basin.

The sedimentation basin will provide detention and some degree of percolation that would serve to capture and percolate modest storm events (e.g. perhaps all but say the 2 to 5 largest events in an average year). This will prevent the percolation basin from being operated during routine storm events.

Percolation Basin. The size of the percolation basin (play field) was determined using the King County methodology described in the attached EDA study. For the purposes of sizing the percolation basin, no percolation in the sedimentation basin is assumed to occur during a storm event due to the possible restriction of percolation caused by siltation at the bottom of the sedimentation basin. However, the storage volume component of the sedimentation basin will be used to calculate the required size of the percolation basin.

The percolation basin size is thus calculated using the methodology developed in the EDA study with the following formula:

$54\ T_{CN}\ Q_N = V_S + A_B\ d + 0.075\ T_{CN}\ A_B / P$, where

T_{CN} = time of concentration for Q_N (min)
Q_N = peak flow with return frequency N (cfs)
N = return frequency (yr)
V_S = volume of the sedimentation basin (cf)
A_B = area of percolation basin bottom (sf)
d = depth of percolation basin (ft)
P = percolation rate (min/in)

The value for the time of concentration is 28.4 min as presented in the EDA study. The peak flows for given storm intervals are presented in Table A. The volume of the sedimentation basin is 57,000 cf. The area of the percolation basin will be calculated. The depth of the percolation basin is 2.0 feet.

The percolation rate of the percolation basin is assumed to be 5.0 min/in for this report. By comparison, the calculated percolation rate for the existing conditions at the WWTF site is 0.63 min/in as presented in the attached EDA study. Basin infiltration tests were conducted at the Broderson effluent disposal site per the report entitled "Hydrology Evaluation of the Proposed Broderson Recharge Site Los Osos CA" dated February 26, 1996 prepared by Metcalf & Eddy. The results ranged from 7 to 25 inches per hour or 2.4 to 8.6 min/in. The soil characteristics at the Broderson site and the WWTF site are similar. Consequently, the percolation rate of 5.0 min/in is considered a representative rate, especially considering that the King County methodology uses a safety factor of 2.

With the above values and parameters, the required area of the percolation basin for a 100-year storm event can be calculated as follows:

$54\ T_{CN}\ Q_N = V_S + A_B\ d + 0.075\ T_{CN}\ A_B / P$

$54 \times 28.4 \text{ min} \times 174 \text{ cfs} = 57{,}000 \text{ cf} + A_B \times 2.0 \text{ ft} + 0.075 \times 28.4 \text{ min} \times A_B / 5.0 \text{ min/in}$

$267{,}000 = 57{,}000 + 2.0\ A_B + 0.426\ A_B$

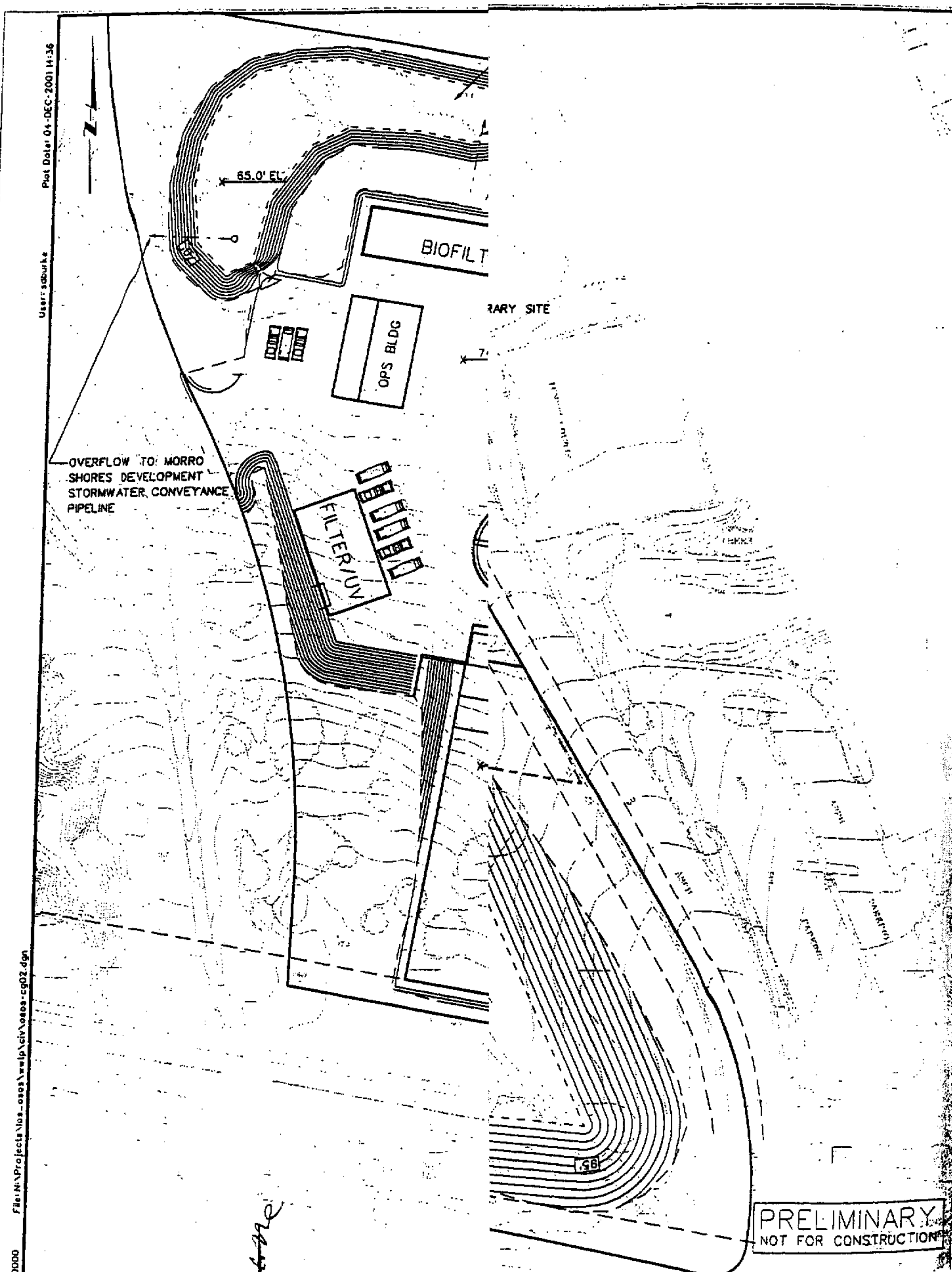
$210{,}000 = 2.426\ A_B$

$A_B = 87{,}000$ sf

Conclusion

The design of the WWTF for the Los Osos Wastewater project will incorporate a retention basin for on-site drainage that will be designed in accordance with SLO County requirements for a 50/10/10 storm event. This design will be developed as part of the preliminary design effort for the WWTF when the plant layout, building sizes, paved areas, and other impervious surfaces will be established.

The design of the WWTF site will also incorporate facilities to handle off-site drainage from tributary areas south of LOVR. The off-site drainage facilities will consist of a sedimentation basin and percolation basin as presented in this Drainage Report. The proposed percolation basin area of 87,000 sf is greater than the estimated size of the existing percolation area of 78,000 sf. The design methodology uses a safety factor of 2 and does not provide any percolation credit to the sedimentation basin. The details of the off-site drainage facilities will be advanced during the final design effort for the WWTF and submitted to SLO County for review and acceptance.



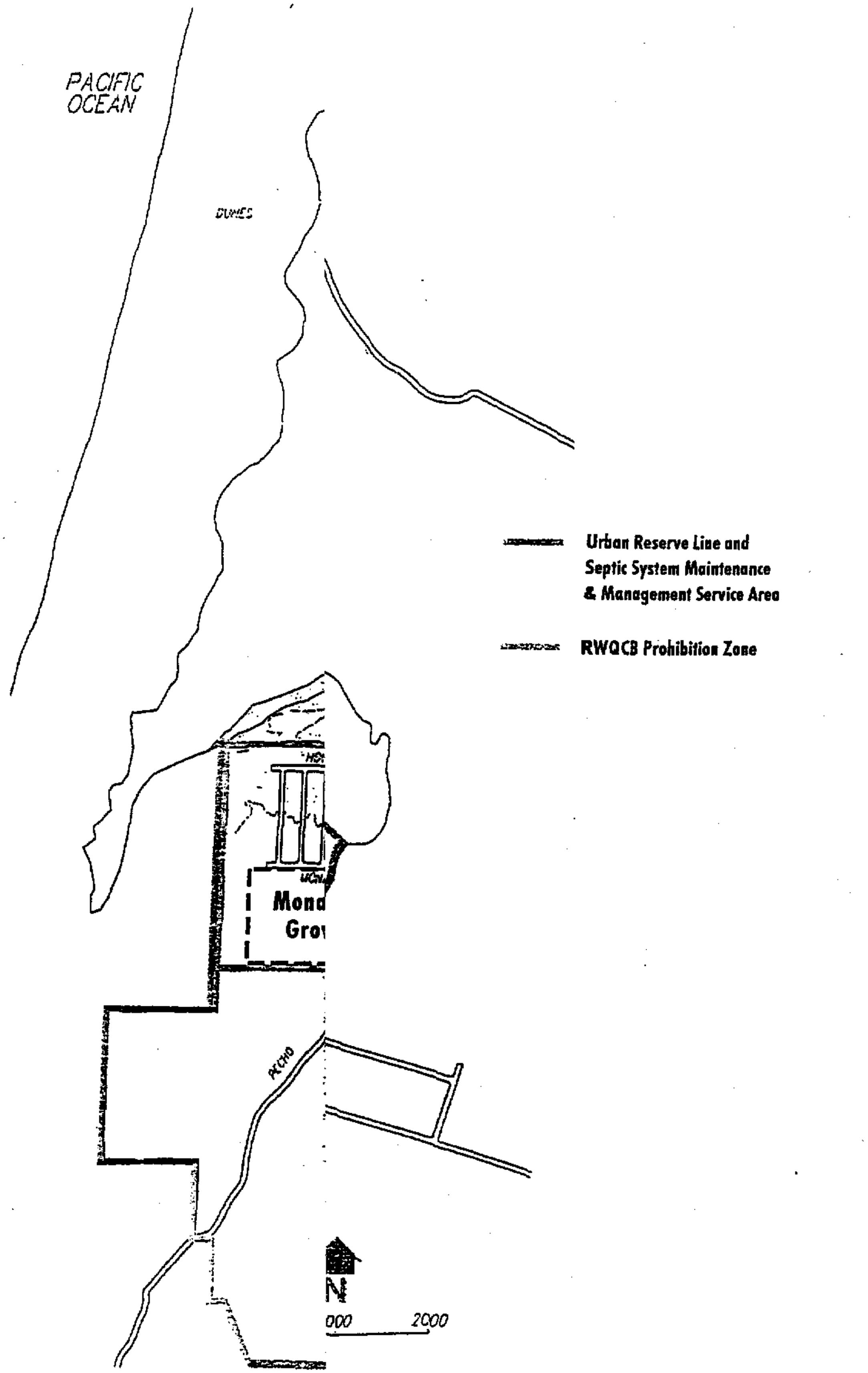
REV	DATE	BY	DESCRIPTION

SCALE

WARNING
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

TRI-W SITE
WASTEWATER TREATMENT FACILITY
CONCEPTUAL GRADING
AND DRAINAGE PLAN

FIGURE
1



MWH
MONTGOMERY WATSON HARZA

Figure 2 - Off-Site Drainage Area
LOCSD

Drainage Study and Report for the Proposed Los Osos Wastewater Treatment Facility

FOR

Montgomery-Watson-Harza

LOS OSOS, CALIFORNIA

APRIL 5, 2002

PREPARED BY:

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REPORT SUMMARY

The proposed site for the Los Osos Wastewater Treatment Facility currently accepts concentrated storm water flows from a large tributary area. Historically, observers have reported that the majority of these flows have soaked into the native soils and have not drained off the project site. The amount of storm water flows is up to 174 cfs in a 100 year storm.

The proposed Treatment Facility will include a percolation basin and a sedementation basin to handle the off-site storm water contributions. The combination of basins will contain a 100 year storm event based on percolation rates derived from on-site testing. The design calculations for this basin and percolation testing procedures are based on the design methodology for percolation basins as administered by King County, Washington.

A storm water retention basin for on-site impervious areas that will be designed following standard County design methodology. The storm water retention basin for on-site drainage is anticipated to be approximately 67,000 cubic feet.

This report summarizes the analysis of 100 year flows as they traverse the existing site. As drainage flows across the site, the flows are absorbed at an assumed uniform rate into the existing soil. Based on the average velocity of the flows, the length of the channel and the surface area of the flow, a relative infiltration factor can be determined. The results of this analysis can be found in Appendix A.

The site design of the new facility will provide a percolation basin that is intended to provide equivalent infiltration of storm water flows as the existing site. Modeling storm flows as they enter the site and percolate into the basin is accomplished by basin routing. Peak flows that enter the site are broken down to a synthetic inflow hydrograph based on standard SCS formulae. This hydrograph is routed through the proposed basin with the percolation rate and surface area providing for the outflow. The basis for the synthetic hydrograph and the basin routing spreadsheet are shown in Appendix B.

Finally this report will derive a standard methodology for sizing the percolation basin for this project. The formula provided will provide a standardized method for determining basin size and volume requirements for a percolation basin assuming open public access. The derivation of this formula is contained in Appendix C.

DRAINAGE METHODOLOGY

The purpose of this report is to establish a drainage analysis methodology that can approximate existing hydrologic conditions for the drainage tributary to the Waste Water Treatment site and allow design of storm water facilities to duplicate existing conditions. The source of data for storm water flows entering the site were taken from the Preliminary Drainage Evaluation, Los Osos / Baywood Park Community (EDA, 4/98).

The project site is located in the community of Los Osos at the northwest corner of Los Osos Valley Road and Palisades Avenue. The site comprises approximately 11 acres of undeveloped land. There is a large drainage swale that roughly bisects the site and runs from south to north. The existing on site elevations vary from elevation 69 to 104.

Anecdotal evidence is that storm water flows are absorbed into the existing soils before leaving the project site. Those individuals interviewed relayed personal observations going back 30+ years. It may be questionable whether there has been a 100 year storm within this time period, however there seems to be little doubt that a 50 year storm has been observed. The peak 100 year flow entering the site is approximately 174 cfs and the peak 50 year flow is approximately 122 cfs per the Preliminary Drainage Evaluation.

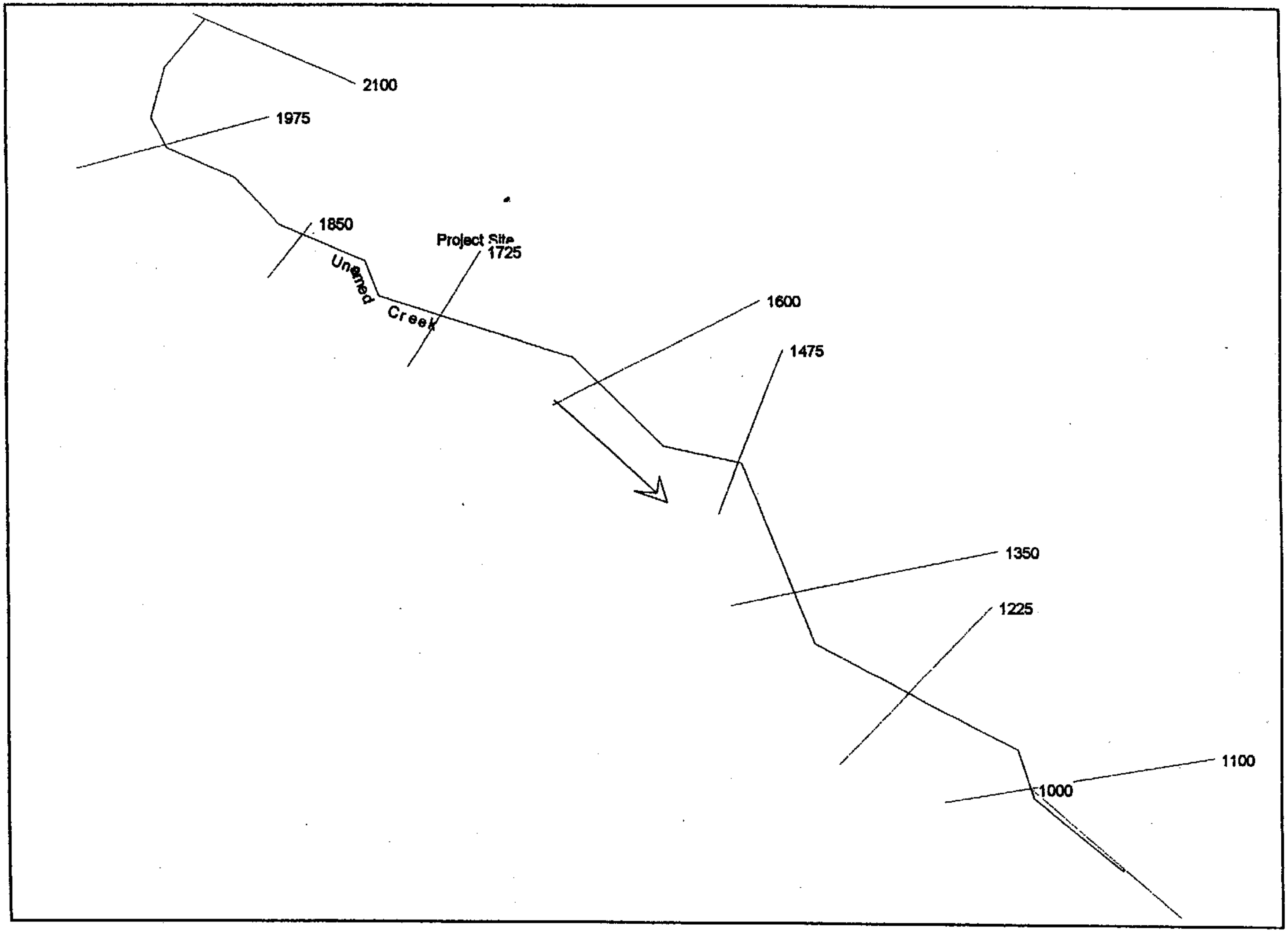
Existing drainage flows were modeled to approximate water surface areas given the assumption that storm water flows do not leave the site. A HEC2 analysis of the existing swale channel was performed using flows in 10 cfs steps from 10 cfs to 180 cfs. The data set derived could then be used to approximate the water surface area of the peak 100 year flow (174 cfs) entering the site and percolating into the swale bottom uniformly to the northerly property line of the site. A map of this area is presented in this report. The data set also allows the derivation of an average velocity of the storm water flows as they traverse the site as well as the approximate contact time. Based on the interpolated percolation surface area and contact time a representative percolation rate can be identified. This information is presented in Appendix A.

The proposed facility layout contains a dedicated sedimentation basin for pretreatment and a percolation basin designated for infiltration of off-site storm water flows. The County of San Luis Obispo does not have a methodology for modeling a detention basin where the outflow is derived through infiltration. The standard methodology for sizing of percolation basins used in Kings County, Washington is proposed for use to basin route the storm water flows. This methodology provides for a safety factor of 2 during the design process. A synthetic inflow hydrograph based on standard SCS methodology was used for basin routing. The derivation of the synthetic hydrograph along with sample basin routings for 25, 50 and 100 years storms assuming a conservative 5 minutes/inch percolation rate are shown in Appendix B.

Finally, based on information derived from our analysis of the existing drainage conditions and sample basin routings, a proposed percolation design formula was developed. The results obtained using this formula agree with the basin routings within a few percent. The formula is intended to be used by designers or percolation basins without taking the time of basin routing. The formula and its derivation are shown in Appendix C.

APPENDIX A

HEC analysis of Existing channel
Water Surface Area Map
Off-Site Drainage Area Map
Analysis of Existing Infiltration Rate


2100
1975
1850
Project Site
1725
Unamed Creek
1600
1475
1350
1225
1100
1000

HEC-RAS Plan: Plan 01 River: Unnamed Creek Reach: Project Site

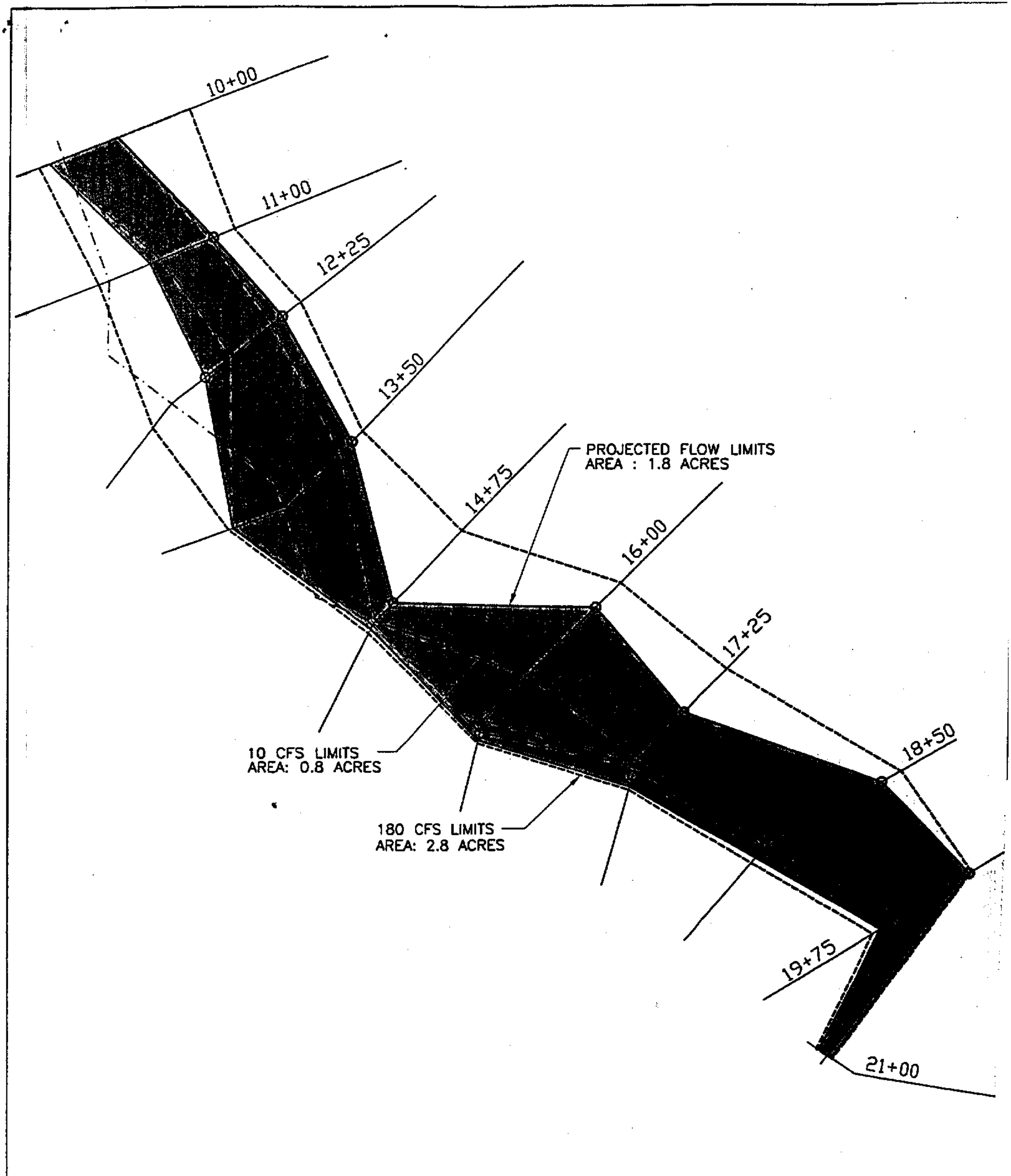
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project Site	2100	180.00	96.00	98.47	98.47	99.12	0.017583	6.49	27.75	21.59	1.01
Project Site	2100	170.00	96.00	98.40	98.40	99.05	0.017708	6.45	26.37	20.81	1.01
Project Site	2100	160.00	96.00	98.33	98.33	98.97	0.017814	6.40	24.99	19.99	1.01
Project Site	2100	150.00	96.00	98.26	98.26	98.89	0.017860	6.35	23.62	19.15	1.01
Project Site	2100	140.00	96.00	98.19	98.19	98.80	0.017795	6.28	22.28	18.30	1.00
Project Site	2100	130.00	96.00	98.11	98.11	98.71	0.018028	6.26	20.75	17.26	1.01
Project Site	2100	120.00	96.00	98.02	98.02	98.62	0.018068	6.22	19.28	16.21	1.01
Project Site	2100	110.00	96.00	97.93	97.93	98.52	0.018649	6.16	17.86	15.64	1.02
Project Site	2100	100.00	96.00	97.86	97.86	98.41	0.018454	5.97	16.75	15.26	1.00
Project Site	2100	90.00	96.00	97.77	97.77	98.30	0.018742	5.82	15.47	14.86	1.00
Project Site	2100	80.00	96.00	97.68	97.68	98.18	0.019102	5.66	14.15	14.40	1.01
Project Site	2100	70.00	96.00	97.59	97.59	98.05	0.019004	5.42	12.91	13.97	0.99
Project Site	2100	60.00	96.00	97.48	97.48	97.91	0.020259	5.29	11.34	13.39	1.01
Project Site	2100	50.00	96.00	97.37	97.37	97.77	0.020852	5.05	9.89	12.84	1.01
Project Site	2100	40.00	96.00	97.25	97.25	97.60	0.021577	4.77	8.39	12.24	1.01
Project Site	2100	30.00	96.00	97.11	97.11	97.42	0.022695	4.42	6.79	11.57	1.02
Project Site	2100	20.00	96.00	96.96	96.96	97.20	0.023817	3.97	5.04	10.53	1.01
Project Site	2100	10.00	96.00	96.73	96.73	96.91	0.025545	3.42	2.92	8.02	1.00
Project Site	1975	180.00	92.50	93.93		94.13	0.015528	3.61	49.82	88.18	0.85
Project Site	1975	170.00	92.50	93.90		94.10	0.015943	3.61	47.10	85.16	0.86
Project Site	1975	160.00	92.50	93.86		94.07	0.016742	3.64	43.99	81.57	0.87
Project Site	1975	150.00	92.50	93.81		94.03	0.018460	3.74	40.14	76.88	0.91
Project Site	1975	140.00	92.50	93.79		94.00	0.017987	3.65	38.34	74.60	0.90
Project Site	1975	130.00	92.50	93.74		93.96	0.019670	3.74	34.78	69.65	0.93
Project Site	1975	120.00	92.50	93.68	93.67	93.92	0.023170	3.93	30.53	64.31	1.01
Project Site	1975	110.00	92.50	93.64	93.64	93.87	0.023296	3.86	28.51	61.96	1.00
Project Site	1975	100.00	92.50	93.61	93.61	93.83	0.023717	3.80	26.32	59.33	1.01
Project Site	1975	90.00	92.50	93.56	93.56	93.79	0.024762	3.77	23.87	56.24	1.02
Project Site	1975	80.00	92.50	93.52	93.52	93.74	0.025257	3.70	21.63	53.25	1.02
Project Site	1975	70.00	92.50	93.48	93.48	93.68	0.025585	3.61	19.41	50.12	1.02
Project Site	1975	60.00	92.50	93.43	93.43	93.62	0.026147	3.51	17.08	46.59	1.02
Project Site	1975	50.00	92.50	93.38	93.38	93.56	0.026458	3.39	14.74	42.79	1.02
Project Site	1975	40.00	92.50	93.32	93.32	93.48	0.027280	3.27	12.21	38.22	1.02
Project Site	1975	30.00	92.50	93.24	93.24	93.40	0.028068	3.13	9.59	32.82	1.02
Project Site	1975	20.00	92.50	93.15	93.15	93.28	0.028888	2.95	6.77	25.81	1.02
Project Site	1975	10.00	92.50	92.99	92.99	93.11	0.028861	2.81	3.56	14.62	1.00
Project Site	1850	180.00	88.60	91.44	91.44	91.97	0.018662	5.84	30.85	29.52	1.01
Project Site	1850	170.00	88.60	91.37	91.37	91.91	0.018609	5.90	28.83	27.02	1.01
Project Site	1850	160.00	88.60	91.29	91.29	91.85	0.018257	5.96	26.84	24.31	1.00
Project Site	1850	150.00	88.60	91.19	91.19	91.77	0.017718	6.14	24.42	20.52	0.99
Project Site	1850	140.00	88.60	90.91	90.91	91.67	0.017645	6.99	20.02	13.66	1.02
Project Site	1850	130.00	88.60	90.84	90.84	91.57	0.017680	6.83	19.03	13.36	1.01
Project Site	1850	120.00	88.60	90.80	90.76	91.45	0.016406	6.51	18.44	13.19	0.97
Project Site	1850	110.00	88.60	90.69	90.67	91.34	0.017129	6.46	17.04	12.76	0.98
Project Site	1850	100.00	88.60	90.65	90.57	91.22	0.015341	6.04	16.55	12.60	0.93
Project Site	1850	90.00	88.60	90.61	90.47	91.10	0.013584	5.62	16.02	12.43	0.87
Project Site	1850	80.00	88.60	90.52		90.97	0.013030	5.36	14.93	12.08	0.85
Project Site	1850	70.00	88.60	90.41		90.82	0.012763	5.12	13.66	11.65	0.83
Project Site	1850	60.00	88.60	90.21	90.13	90.64	0.015666	5.28	11.35	10.83	0.91
Project Site	1850	50.00	88.60	90.09	89.99	90.47	0.015223	4.97	10.07	10.34	0.89
Project Site	1850	40.00	88.60	89.95	89.85	90.28	0.014489	4.58	8.74	9.82	0.85
Project Site	1850	30.00	88.60	89.80	89.68	90.06	0.013655	4.12	7.29	9.20	0.82
Project Site	1850	20.00	88.60	89.60	89.49	89.80	0.013674	3.65	5.49	8.38	0.79
Project Site	1850	10.00	88.60	89.34	89.24	89.47	0.013263	2.90	3.45	7.35	0.75
Project Site	1725	180.00	86.80	88.47	88.47	88.68	0.025703	3.61	49.82	128.48	1.02
Project Site	1725	170.00	86.80	88.46	88.46	88.65	0.025865	3.55	47.86	127.30	1.02
Project Site	1725	160.00	86.80	88.44	88.44	88.63	0.025716	3.47	46.09	126.22	1.01
Project Site	1725	150.00	86.80	88.43	88.43	88.61	0.026156	3.41	43.93	124.69	1.01
Project Site	1725	140.00	86.80	88.41	88.41	88.58	0.026982	3.37	41.56	123.42	1.02
Project Site	1725	130.00	86.80	88.39	88.39	88.56	0.027167	3.29	39.50	122.14	1.02
Project Site	1725	120.00	86.80	88.36	88.36	88.54	0.032383	3.39	35.41	119.53	1.10
Project Site	1725	110.00	86.80	88.35	88.35	88.51	0.027951	3.13	35.11	119.33	1.02
Project Site	1725	100.00	86.80	88.33	88.33	88.48	0.030149	3.11	32.20	117.44	1.05
Project Site	1725	90.00	86.80	88.30	88.30	88.45	0.034277	3.12	28.87	115.24	1.10
Project Site	1725	80.00	86.80	88.29	88.29	88.42	0.032759	2.96	27.05	112.89	1.06
Project Site	1725	70.00	86.80	88.27	88.27	88.39	0.030427	2.77	25.30	110.47	1.02
Project Site	1725	60.00	86.80	87.99	87.99	88.39	0.020681	5.12	11.71	14.90	1.02
Project Site	1725	50.00	86.80	87.89	87.89	88.26	0.020772	4.88	10.25	14.09	1.01
Project Site	1725	40.00	86.80	87.77	87.77	88.10	0.021466	4.64	8.63	13.14	1.01

HEC-RAS Plan: Plan [illegible] River: [illegible] Creek Reach: Project Site (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project Site	1725	30.00	86.80	87.63	87.63	87.92	0.022153	4.32	6.95	12.07	1.00
Project Site	1725	20.00	86.80	87.49	87.47	87.71	0.021720	3.81	5.25	10.69	0.97
Project Site	1725	10.00	86.80	87.30		87.44	0.019299	2.96	3.38	9.42	0.87
Project Site	1600	180.00	83.70	84.70	84.70	84.85	0.024539	3.12	57.78	180.18	0.97
Project Site	1600	170.00	83.70	84.68	84.68	84.83	0.025673	3.13	54.37	174.42	0.99
Project Site	1600	160.00	83.70	84.67	84.67	84.81	0.025339	3.07	52.17	170.60	0.98
Project Site	1600	150.00	83.70	84.66	84.66	84.79	0.024083	2.96	50.64	167.88	0.95
Project Site	1600	140.00	83.70	84.63	84.63	84.77	0.025519	2.98	46.98	161.22	0.97
Project Site	1600	130.00	83.70	84.62	84.62	84.75	0.025381	2.92	44.48	156.50	0.97
Project Site	1600	120.00	83.70	84.60	84.60	84.73	0.025503	2.87	41.75	151.19	0.96
Project Site	1600	110.00	83.70	84.58	84.58	84.71	0.026066	2.84	38.72	145.06	0.97
Project Site	1600	100.00	83.70	84.56	84.56	84.68	0.026504	2.80	35.75	138.78	0.97
Project Site	1600	90.00	83.70	84.54	84.54	84.65	0.026530	2.73	32.94	132.59	0.97
Project Site	1600	80.00	83.70	84.51	84.51	84.63	0.027381	2.69	29.70	125.05	0.97
Project Site	1600	70.00	83.70	84.48	84.48	84.60	0.030937	2.74	25.52	114.60	1.02
Project Site	1600	60.00	83.70	84.45	84.45	84.56	0.032801	2.71	22.10	105.27	1.04
Project Site	1600	50.00	83.70	84.42	84.42	84.52	0.033675	2.64	18.93	95.62	1.05
Project Site	1600	40.00	83.70	84.38	84.38	84.48	0.033131	2.50	16.01	86.97	1.03
Project Site	1600	30.00	83.70	84.34	84.34	84.43	0.036645	2.43	12.33	75.47	1.06
Project Site	1600	20.00	83.70	84.30	84.30	84.37	0.033146	2.13	9.39	64.81	0.99
Project Site	1600	10.00	83.70	84.22	84.22	84.28	0.034453	1.88	5.32	45.63	0.97
Project Site	1475	180.00	78.90	81.16	81.16	81.37	0.015984	4.12	53.10	123.26	0.87
Project Site	1475	170.00	78.90	81.14	81.14	81.35	0.015831	4.10	50.53	117.16	0.87
Project Site	1475	160.00	78.90	81.12	81.12	81.32	0.015715	4.09	47.87	110.52	0.87
Project Site	1475	150.00	78.90	81.10	81.10	81.30	0.014726	3.96	46.44	106.76	0.84
Project Site	1475	140.00	78.90	81.07	81.07	81.27	0.015024	4.00	43.03	101.13	0.85
Project Site	1475	130.00	78.90	81.04	81.04	81.24	0.015110	4.03	39.83	96.04	0.85
Project Site	1475	120.00	78.90	81.03	81.03	81.21	0.013650	3.84	38.65	94.06	0.81
Project Site	1475	110.00	78.90	81.00	81.00	81.18	0.013224	3.79	35.87	89.38	0.80
Project Site	1475	100.00	78.90	80.96	80.96	81.14	0.013024	3.71	33.06	84.63	0.79
Project Site	1475	90.00	78.90	80.91	80.91	81.10	0.013939	3.77	26.94	77.15	0.81
Project Site	1475	80.00	78.90	80.87	80.87	81.06	0.014307	3.74	25.44	70.16	0.82
Project Site	1475	70.00	78.90	80.82	80.82	81.01	0.014098	3.65	22.37	63.40	0.80
Project Site	1475	60.00	78.90	80.74	80.74	80.95	0.015751	3.74	17.87	51.93	0.84
Project Site	1475	50.00	78.90	80.63	80.63	80.87	0.018920	3.93	13.05	35.76	0.91
Project Site	1475	40.00	78.90	80.47	80.47	80.75	0.023857	4.19	9.55	17.80	1.01
Project Site	1475	30.00	78.90	80.33	80.33	80.59	0.024533	4.14	7.25	13.87	1.01
Project Site	1475	20.00	78.90	79.94	79.94	80.36	0.024726	5.17	3.87	4.89	1.02
Project Site	1475	10.00	78.90	79.66	79.61	79.90	0.020184	3.92	2.55	4.31	0.90
Project Site	1350	180.00	77.00	77.47	77.47	77.66	0.025224	3.56	51.64	139.04	1.01
Project Site	1350	170.00	77.00	77.46	77.46	77.64	0.025757	3.50	49.43	137.93	1.02
Project Site	1350	160.00	77.00	77.44	77.44	77.62	0.026197	3.43	47.28	136.63	1.02
Project Site	1350	150.00	77.00	77.43	77.43	77.60	0.025643	3.32	45.67	136.01	1.00
Project Site	1350	140.00	77.00	77.41	77.41	77.57	0.026837	3.27	43.06	134.65	1.01
Project Site	1350	130.00	77.00	77.40	77.40	77.55	0.026447	3.16	41.26	133.71	1.00
Project Site	1350	120.00	77.00	77.38	77.38	77.53	0.027671	3.09	38.62	132.33	1.01
Project Site	1350	110.00	77.00	77.36	77.36	77.50	0.026954	2.98	36.84	131.38	0.99
Project Site	1350	100.00	77.00	77.35	77.35	77.48	0.027245	2.85	34.54	130.15	0.99
Project Site	1350	90.00	77.00	77.33	77.33	77.45	0.027637	2.74	32.15	128.86	0.98
Project Site	1350	80.00	77.00	77.31	77.30	77.42	0.027475	2.60	29.88	127.62	0.97
Project Site	1350	70.00	77.00	77.29	77.29	77.39	0.026945	2.43	27.81	126.37	0.94
Project Site	1350	60.00	77.00	77.27	77.27	77.36	0.025736	2.24	25.40	125.14	0.91
Project Site	1350	50.00	77.00	77.25	77.25	77.33	0.024342	2.04	23.01	123.80	0.87
Project Site	1350	40.00	77.00	77.22	77.22	77.29	0.028336	1.91	19.00	121.51	0.91
Project Site	1350	30.00	77.00	77.20	77.19	77.26	0.023762	1.59	16.71	120.16	0.81
Project Site	1350	20.00	77.00	77.17	77.15	77.21	0.023874	1.39	12.46	107.17	0.78
Project Site	1350	10.00	77.00	77.11	77.11	77.14	0.025098	1.11	7.44	88.17	0.75
Project Site	1225	180.00	73.50	74.13	74.13	74.32	0.025767	3.43	52.56	149.51	1.01
Project Site	1225	170.00	73.50	74.13	74.13	74.30	0.024927	3.33	51.24	149.02	0.99
Project Site	1225	160.00	73.50	74.11	74.11	74.28	0.026576	3.32	48.35	147.93	1.01
Project Site	1225	150.00	73.50	74.09	74.09	74.26	0.027015	3.25	46.20	147.11	1.02
Project Site	1225	140.00	73.50	74.08	74.08	74.23	0.027512	3.18	44.01	146.26	1.02
Project Site	1225	130.00	73.50	74.07	74.07	74.21	0.026554	3.06	42.49	145.70	0.99
Project Site	1225	120.00	73.50	74.06	74.06	74.19	0.022905	2.84	42.33	145.63	0.92
Project Site	1225	110.00	73.50	74.03	74.03	74.17	0.027468	2.90	37.92	143.93	0.99
Project Site	1225	100.00	73.50	74.02	74.02	74.14	0.027954	2.81	35.56	143.01	0.99
Project Site	1225	90.00	73.50	74.00	74.00	74.12	0.028685	2.73	33.00	142.00	1.00
Project Site	1225	80.00	73.50	73.98	73.98	74.09	0.029473	2.64	30.28	138.75	1.00

HEC-RAS Plan: Plan 01 River: Unnamed Creek Reach: Project Site (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Project Site	1225	70.00	73.50	73.96	73.96	74.06	0.030173	2.55	27.48	135.31	1.00
Project Site	1225	60.00	73.50	73.93	73.93	74.03	0.032849	2.49	24.11	131.06	1.02
Project Site	1225	50.00	73.50	73.92	73.92	74.00	0.031589	2.31	21.65	127.87	0.99
Project Site	1225	40.00	73.50	73.89	73.89	73.96	0.033698	2.22	18.03	118.69	1.00
Project Site	1225	30.00	73.50	73.85	73.85	73.92	0.034352	2.12	14.16	101.35	1.00
Project Site	1225	20.00	73.50	73.80	73.80	73.87	0.035257	2.02	9.92	78.07	1.00
Project Site	1225	10.00	73.50	73.73	73.73	73.78	0.037684	1.92	5.20	46.18	1.01
Project Site	1100	180.00	71.30	71.71	71.71	71.93	0.017537	1.96	50.18	112.41	0.76
Project Site	1100	170.00	71.30	71.68	71.68	71.90	0.018127	1.89	47.34	109.19	0.76
Project Site	1100	160.00	71.30	71.65	71.65	71.88	0.018727	1.83	44.47	105.14	0.77
Project Site	1100	150.00	71.30	71.63	71.63	71.85	0.019155	1.76	41.81	101.23	0.77
Project Site	1100	140.00	71.30	71.60	71.60	71.82	0.019286	1.68	39.42	97.59	0.76
Project Site	1100	130.00	71.30	71.58	71.58	71.79	0.019482	1.59	36.96	93.70	0.75
Project Site	1100	120.00	71.30	71.55	71.55	71.76	0.019543	1.49	34.59	89.79	0.74
Project Site	1100	110.00	71.30	71.52	71.52	71.72	0.020426	1.39	31.67	84.71	0.74
Project Site	1100	100.00	71.30	71.49	71.49	71.68	0.021030	1.27	28.98	79.77	0.73
Project Site	1100	90.00	71.30	71.45	71.45	71.64	0.021837	1.12	26.24	74.38	0.72
Project Site	1100	80.00	71.30	71.41	71.41	71.60	0.022635	0.94	23.57	68.74	0.70
Project Site	1100	70.00	71.30	71.37	71.37	71.55	0.024169	0.71	20.73	62.17	0.67
Project Site	1100	60.00	71.30	71.33	71.33	71.50	0.025172	0.39	18.21	55.70	0.58
Project Site	1100	50.00	71.30	71.28	71.28	71.44	0.027007		15.64	50.41	0.00
Project Site	1100	40.00	71.30	71.23	71.23	71.37	0.027329		13.37	48.03	0.00
Project Site	1100	30.00	71.30	71.18	71.18	71.30	0.027599		10.96	45.38	0.00
Project Site	1100	20.00	71.30	71.12	71.11	71.21	0.029631		8.16	42.05	0.00
Project Site	1100	10.00	71.30	71.05		71.10	0.024405		5.52	38.66	0.00
Project Site	1000	180.00	68.80	69.54	69.46	69.68	0.013305	3.09	60.04	125.68	0.77
Project Site	1000	170.00	68.80	69.52	69.44	69.66	0.013306	3.03	57.88	124.95	0.77
Project Site	1000	160.00	68.80	69.51	69.42	69.63	0.013306	2.96	55.68	124.21	0.76
Project Site	1000	150.00	68.80	69.49	69.41	69.61	0.013309	2.89	53.43	123.45	0.76
Project Site	1000	140.00	68.80	69.47	69.39	69.59	0.013309	2.82	51.13	122.67	0.75
Project Site	1000	130.00	68.80	69.45	69.37	69.56	0.013311	2.75	48.77	121.86	0.75
Project Site	1000	120.00	68.80	69.43	69.35	69.53	0.013314	2.67	46.36	121.02	0.74
Project Site	1000	110.00	68.80	69.41	69.33	69.51	0.013317	2.59	43.87	120.15	0.74
Project Site	1000	100.00	68.80	69.39	69.32	69.48	0.013323	2.50	41.30	119.25	0.73
Project Site	1000	90.00	68.80	69.36	69.30	69.45	0.013302	2.40	38.66	118.32	0.72
Project Site	1000	80.00	68.80	69.34	69.27	69.42	0.013303	2.30	35.90	117.33	0.71
Project Site	1000	70.00	68.80	69.32	69.25	69.39	0.013304	2.19	33.02	116.30	0.71
Project Site	1000	60.00	68.80	69.29	69.22	69.35	0.013306	2.08	29.83	113.75	0.70
Project Site	1000	50.00	68.80	69.26	69.19	69.31	0.013321	1.96	26.22	108.26	0.69
Project Site	1000	40.00	68.80	69.22	69.16	69.27	0.013314	1.82	22.42	102.17	0.67
Project Site	1000	30.00	68.80	69.18	69.12	69.22	0.013305	1.65	18.36	95.22	0.66
Project Site	1000	20.00	68.80	69.13	69.08	69.16	0.013322	1.43	13.87	86.92	0.64
Project Site	1000	10.00	68.80	69.07	69.03	69.09	0.013310	1.10	8.65	76.12	0.59



PREPARED BY:

EDA ENGINEERING DEVELOPMENT ASSOCIATES

[illegible] STREET SAN LUIS OBISPO, CA 93401 805/548-8658
[illegible] OAK STREET PASO ROBLES, CA 93446 805/237-1033

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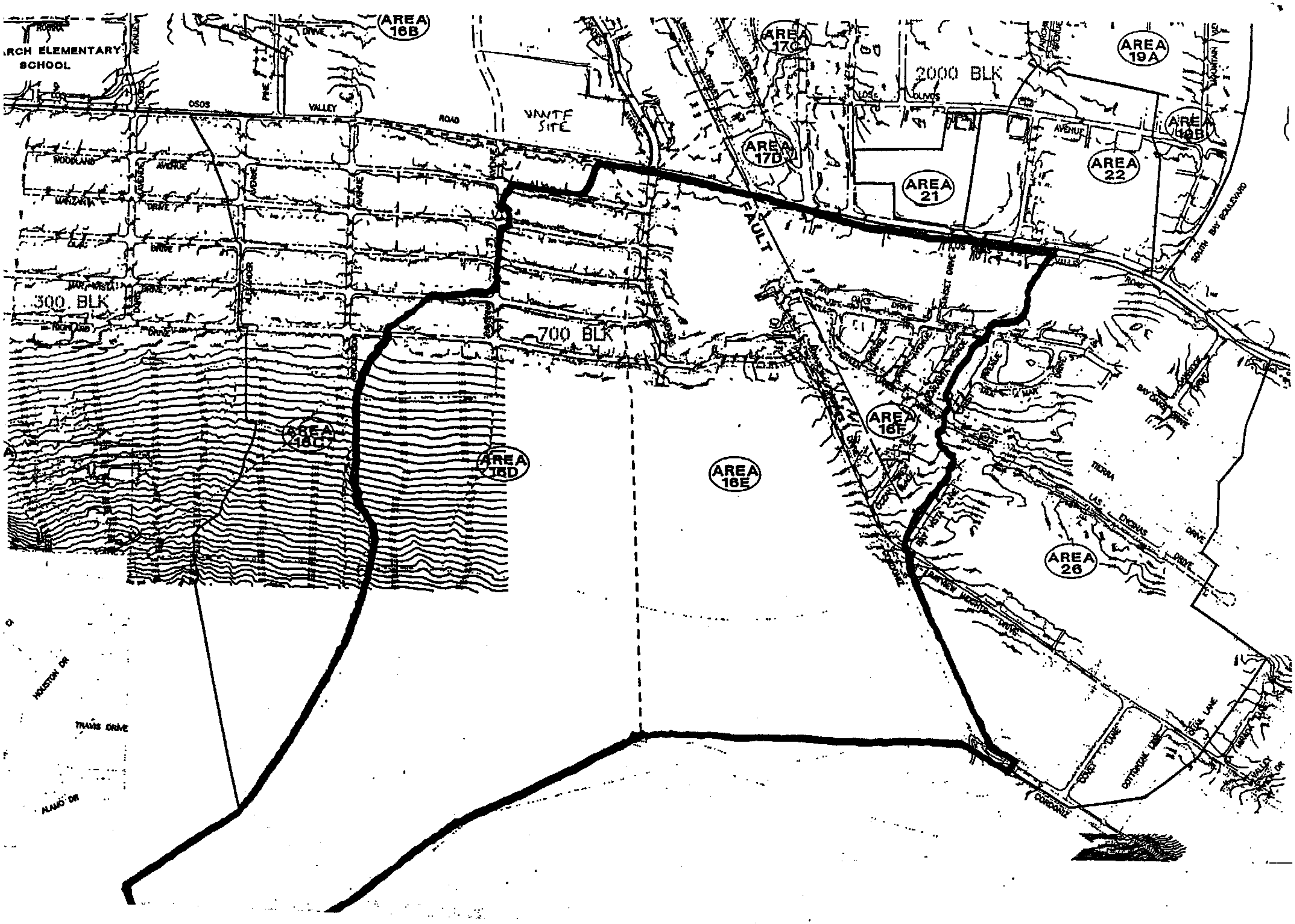
ARCH ELEMENTARY SCHOOL
AREA 16B
AREA 17C
AREA 17D
AREA 19A
AREA 19B
AREA 21
AREA 22
AREA 16C
AREA 16D
AREA 16E
AREA 16F
AREA 26
2000 BLK
300 BLK
700 BLK
WWTF SITE
OSOS VALLEY ROAD
LOS OLIVOS AVENUE
SOUTH BAY BOULEVARD
FAULT
WOODLAND
MANZANITA DRIVE
ALEXANDER AVENUE
SUNSET DRIVE
LAS ENCINAS DRIVE
TIERRA
FAIRVIEW HEIGHTS DRIVE
CORDONIZ
HOUSTON DR
TRAVIS DRIVE
ALAMO DR

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ESTIMATE EXISTING INFILTRATION RATE ASSUMING 100% PERCOLATION OF 100YR FLOWS.

Q = 175 cfs AT LOVR.

STA	Q	VELOCITY	FLOW AREA
21+00	180	6.49	27.75
19+75	160	3.64	43.99
18+50	140	6.99	20.02
17+25	120	3.39	35.41
16+00	100	2.80	35.75
14+75	80	3.14	25.44
13+50	60	2.24	25.40
12+25	40	2.2	18.03
11+00	20	1.4 (ASSUMED)	13.37
10+00	10	1.1	8.65

$\frac{\Sigma V}{10}$ = 3.40 fps AVE VELOCITY

$\frac{1100}{3.4}$ = 323 s = 5.4 min

TOTAL VOLUME = 323 × 175 = 56,525 cf.

SURFACE AREA = 1.8 AC = 78,400 sf.

$\frac{56{,}525}{78400} = 0.72' = 8.6''$

PERC. RATE = $\frac{5.4}{8.6}$ = 0.63 MIN/INCH.

APPENDIX B

King County, Washington Infiltration Methodology
Derivation of Synthetic Inflow Hydrograph
Sample Basin Routing Spreadsheet

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DETERMINE SCS SYNTHETIC HYDROGRAPH:

GIVEN:
PEAK FLOW RATES — $Q = 95\text{CFS}$ w. $T_c = 0.481\text{ HR}$
$Q = 79\text{CFS}$ w. $T_c = 0.465\text{ HR}$

FIND WEIGHTED T_c:

$$T_c = \frac{95\text{CFS}(0.481\text{HR}) + 79\text{CFS}(0.465\text{HR})}{174\text{CFS}} = 0.474\text{HR}$$
$$= 28.4\text{ MIN}$$

HYDROGRAPH PARAMETERS:

$$T_P = 0.6665\,T_c = 0.316\text{ HR}$$
$$T_R = 1.1131\,T_c = 0.527\text{ HR}$$
$$T_B = 1.7796\,T_c = 0.843\text{ HR}$$

RESULTING VOLUME OF STORM:

$$\forall = \tfrac{1}{2} \times 0.843\text{HR} \times 174\ \text{FT}^3/\text{SEC} \times 3600\ \text{SEC}/\text{HR}$$
$$\forall = \underline{\underline{264{,}028\text{CF}}}$$
$$\forall = \underline{\underline{6.06\text{AC-FT}}}$$

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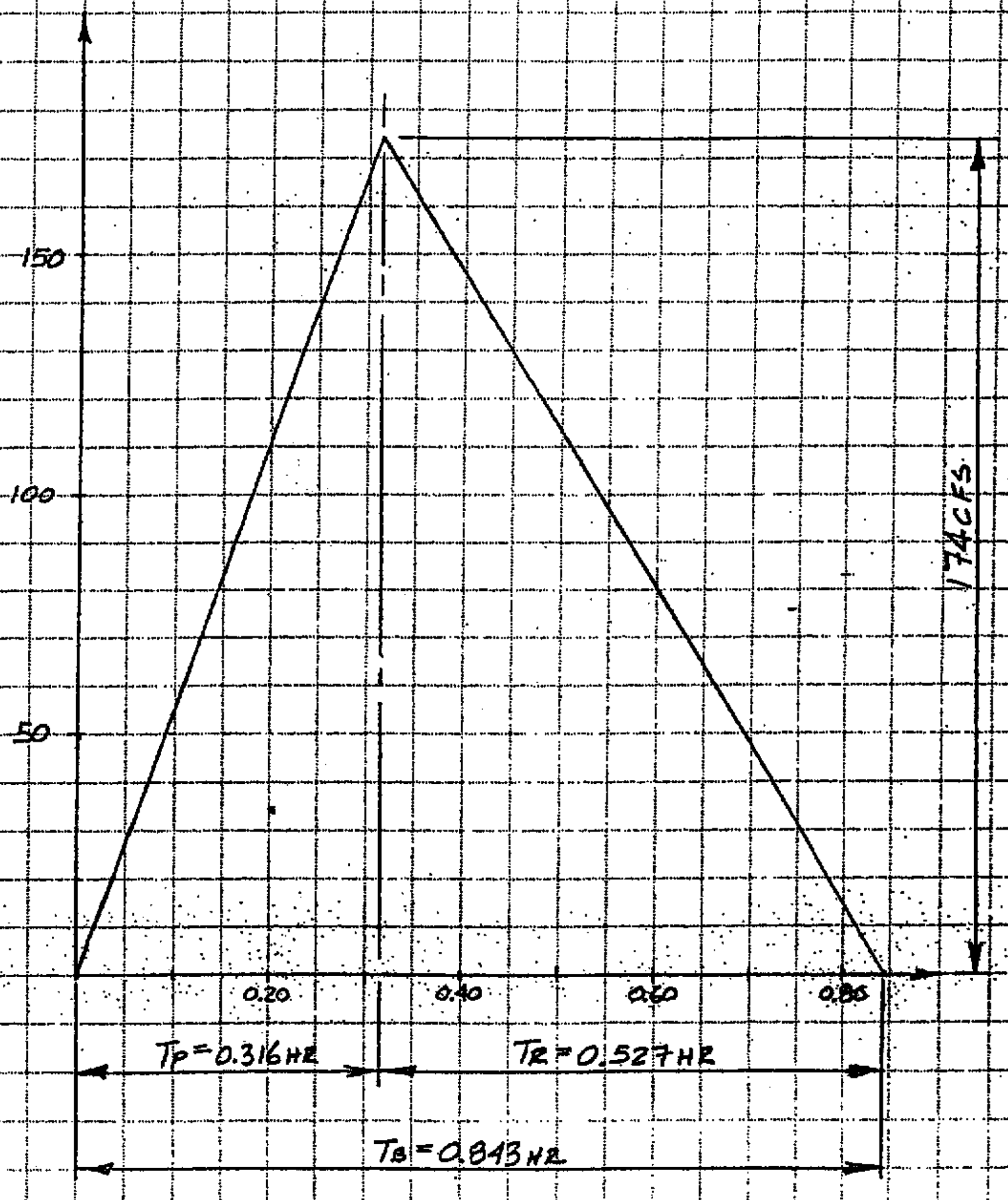

DATE: 06-Feb-02
JOB No: 22650000
JOB NAME: Los Osos Sewer
CALC BY: MR
CHK BY: ____________

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Note:
This spreadsheet routes a 100-year storm through the proposed infiltration basin having an area of 80,000 square feet.
[illegible]

Assumed Min. Infiltration = 0.2 $^{inches}/_{minute}$ (or a 5.0 $^{minutes}/_{inch}$ percolation rate)

	Time (min)	Duration (hr)	Inflow, Q (cfs) see hydrograph	Average. In, Q_{avg} (cfs) $(Q + Q_{prev})/2$	Volume In (cf) Δ Time x Q_{avg}	Total in Storage (cf) $V_{in} + V_{balance}$	W_s Depth (cf) from W_s vs Vol.	Area of Infiltration Surface (sf) from V_{basin} vs W_s	Outflow (cfs) $Q = I_m A / (720 x 2)$	Average Out (cfs) $(Q_i + Q_{prev})/2$	Volume Out (cf) Δ Time x Q_{avg}	Balance in Storage (cf) $V_{in} - V_{out} + V_{prev}$	Resulting WS Depth (ft) from W_s vs Vol.
	0	0	0	0	0	0	0.00	0	0.0	0.0	0	0	0.00
	1.5	0.025	13.8	6.89	620	620	0.01	80000	11.1	5.6	500	120	0.00
	3.0	0.050	27.6	20.67	1860	1980	0.02	80000	11.1	11.1	1000	980	0.01
	4.5	0.075	41.3	34.44	3100	4080	0.05	80000	11.1	11.1	1000	3080	0.04
	6.0	0.100	55.1	48.22	4340	7419	0.09	80000	11.1	11.1	1000	6419	0.08
	7.5	0.125	68.9	62.00	5580	11999	0.15	80000	11.1	11.1	1000	10999	0.14
	9.0	0.150	82.7	75.77	6820	17819	0.22	80000	11.1	11.1	1000	16819	0.21
	10.5	0.175	96.4	89.55	8060	24878	0.31	80000	11.1	11.1	1000	23878	0.30
	12.0	0.200	110.2	103.33	9299	33178	0.41	80000	11.1	11.1	1000	32178	0.40
	13.5	0.225	124.0	117.10	10539	42717	0.53	80000	11.1	11.1	1000	41717	0.52
	15.0	0.250	137.8	130.88	11779	53496	0.67	80000	11.1	11.1	1000	52496	0.66
	16.5	0.275	151.5	144.66	13019	65515	0.82	80000	11.1	11.1	1000	64515	0.81
	18.0	0.300	165.3	158.43	14259	78775	0.98	80000	11.1	11.1	1000	77775	0.97
Peak Flowrate	18.94	0.316	174.0	169.66	9617	87391	1.09	80000	11.1	11.1	630	86762	1.08
	19.5	0.325	170.9	172.47	5746	92508	1.16	80000	11.1	11.1	370	92138	1.15
	21.0	0.350	162.7	166.82	15014	107152	1.34	80000	11.1	11.1	1000	106152	1.33
	22.5	0.375	154.4	158.57	14271	120423	1.51	80000	11.1	11.1	1000	119423	1.49
	24.0	0.400	146.2	150.32	13529	132952	1.66	80000	11.1	11.1	1000	131952	1.65
	25.5	0.425	137.9	142.07	12787	144739	1.81	80000	11.1	11.1	1000	143739	1.80
	27.0	0.450	129.7	133.82	12044	155783	1.95	80000	11.1	11.1	1000	154783	1.93
	28.5	0.475	121.5	125.57	11302	166085	2.08	80000	11.1	11.1	1000	165085	2.06
	30.0	0.500	113.2	117.33	10559	175644	2.20	80000	11.1	11.1	1000	174644	2.18
	31.5	0.525	105.0	109.08	9817	184461	2.31	80000	11.1	11.1	1000	183461	2.29
	33.0	0.550	96.7	100.83	9074	192535	2.41	80000	11.1	11.1	1000	191535	2.39
	34.5	0.575	88.5	92.58	8332	199867	2.50	80000	11.1	11.1	1000	198867	2.49
	36.0	0.600	80.2	84.33	7590	206457	2.58	80000	11.1	11.1	1000	205457	2.57
	37.5	0.625	72.0	76.08	6847	212304	2.65	80000	11.1	11.1	1000	211304	2.64
	39.0	0.650	63.7	67.83	6105	217408	2.72	80000	11.1	11.1	1000	216408	2.71
	40.5	0.675	55.5	59.58	5362	221771	2.77	80000	11.1	11.1	1000	220771	2.76
	42.0	0.700	47.2	51.33	4620	225390	2.82	80000	11.1	11.1	1000	224390	2.80
	43.5	0.725	39.0	43.08	3877	228268	2.85	80000	11.1	11.1	1000	227268	2.84
	45.0	0.750	30.7	34.83	3135	230403	2.88	80000	11.1	11.1	1000	229403	2.87
	46.5	0.775	22.5	26.58	2392	231795	2.90	80000	11.1	11.1	1000	230795	2.88
	48.0	0.800	14.2	18.33	1650	232445	2.91	80000	11.1	11.1	1000	231445	2.89
	49.5	0.825	6.0	10.08	908	232353	2.90	80000	11.1	11.1	1000	231353	2.89
	50.58	0.843	0.0	2.98	193	231546	2.89	80000	11.1	11.1	720	230826	2.89

4.5.2 MAXIMUM INFILTRATION RATE TESTS

The following maximum infiltration rate tests are required in order to provide a conservative estimate of the potential outflow rates for: existing areas providing infiltration, such as closed depressions/wetlands; and, for proposed infiltration facilities. In general, the maximum infiltration rates determined through these tests should not be significantly faster than those shown in Table 4.5.1A for the given soil texture class. If they are significantly faster, the testing procedure, the soil texture classification (Figure 4.5.1B) or the specific site conditions should be reassessed.

Surface Maximum Infiltration Test

The surface maximum infiltration test is used to estimate the average surface maximum infiltration rate (I_M) of the surface soils in a closed depression, retention pond, detention pond, infiltration pond, or in a proposed ponding area that will be constructed by berming (as opposed to excavating). The test is designed to simulate the physical process that will occur during design storm event conditions, therefore, a saturation period is required to approximate the soil moisture conditions that would occur during a major storm event. A pipe is employed to allow only the vertical maximum infiltration to be measured so that it may be used to compute the rate of infiltration over the area of infiltration.

Testing Procedure

(1) Without removing loose top soil and surface debris, a 4-foot-long, 6-inch-inner-diameter section of pipe is driven into the soil a depth of 6 inches.

(2) The pipe is filled and kept to a minimum depth of at least one foot of water above the ground surface, at the bottom inside the pipe, for a period of not less than 4 hours (the saturation period).

(3) Following the saturation period, the pipe is filled to the top and the time required for the water to fall every inch, down to 6 inches below the top of the pipe, is recorded.

(4) The rates for all one-inch times are then averaged to estimate the maximum infiltration rate (I_m). This process is repeated three times, and the average three tests used to compute the maximum infiltration rate (I_m) for the test using the following equation:

$I_m = \Sigma(I_m)_{1,2,3}/3)$; inches/min

Sub-Surface Maximum Infiltration Test

The sub-surface maximum infiltration test is used to estimate the maximum sub-surface vertical infiltration rate at a particular level in the soil horizon that corresponds with the lowest finished grade elevation of a proposed infiltration tank or pond. The test is designed to simulate the physical process that will occur during design storm event conditions, therefore, a saturation period is required to approximate the soil moisture conditions that would occur during a major storm event. A pipe is employed to allow only the vertical infiltration rate to be measured so that the computed maximum infiltration may be used to compute the rate of seepage over the area of interest for varying head.

Testing Procedure

(1) A hole is dug to the finished grade elevation of a proposed infiltration tank or pond and of sufficient diameter to allow a 6-inch-inner-diameter section of pipe to be placed in the hole and driven into the soil at test elevation a depth of 6 inches.

(2) The pipe is filled with water and maintained at depths between one and four feet above the test elevation, at the bottom inside of the pipe, for a period of not less than 4 hours (the saturation period).

(3) Following the saturation period, the pipe is filled to the test elevation and the time required for the water to fall every inch, down to 6 inches below the top of the pipe, is recorded.

(4) The rates for all one-inch times are then averaged to estimate the maximum infiltration rate (I_m). This process is repeated three times, and the average of the three tests used to compute the maximum infiltration rate (I_m) for the test using the equation shown above for surface infiltration tests.

Methods of Analysis

Use of I_m in Hydrologic Analysis: Once I_m for a given soil surface elevation has been computed it may be used to develop a stage/discharge curve for use in the "level pool routing" method described in Section 3.5.4, in Chapter 3. At a given stage the discharge can be computed using the area of the surface through which infiltration will occur using the following equation:

$Q_I = I_m A_I/720$; (720 converts inches per minute to feet per second),

where: Q_I = the outflow due to infiltration, in ft^3/sec.

A_I = the area of the infiltration surface, in ft^2.

The area (A_I) available at each stage is determined by planimeter or noted from the areas of contours used in developing the storage available at each stage. Note: for design of proposed infiltration tanks or ponds a factor of safety of 2.0 must be applied to the potential infiltration discharge by dividing by 2.0 ($Q_I/2.0$) for each stage on the stage/discharge curve.

APPENDIX C

Derivation of Basin Volume Formula

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DERIVATION OF PERCOLATION BASIN DESIGN FORMULA

DEFINITIONS

Q_N PEAK FLOW WITH RETURN FREQUENCY N
T_{CN} TIME OF CONCENTRATION FOR Q_N
V_N STORM VOLUME W/RETURN FREQUENCY N
A_B PLAN AREA IN SF OF BASIN BOTTOM
d BASIN DESIGN DEPTH
P PERCOLATION RATE IN MINUTES PER INCH
Q_P BASIN OUTFLOW BASED ON PERCOLATION
V_B BASIN VOLUME = $A_B d$
V_P PERCOLATION VOLUME

$$V_N = V_B + V_P$$

DETERMINE STORM VOLUME V_N

FROM SCS SYNTHETIC HYDROGRAPH

$$V_N = 60 \text{ MIN/HR} \times .5 \times 1.7796 \times T_{CN} \times Q_N$$

$$\Rightarrow .5 \times 1.7796 = .89 \quad \text{ASSUME } .90$$

$$\boxed{V_N = 54 T_{CN} Q_N}$$

PRODUCT 204-1 (Single Sheets) 205-1 (Padded)

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DETERMINE BASIN VOLUME V_B

NEGLECT AREA OF SIDE SLOPES TO ADD FACTOR OF SAFETY TO CALCULATION

$$\boxed{V_B = A_B d}$$

DETERMINE PERCOLATION VOLUME V_P

STORM DURATION = $1.7796\, T_{CN}$

USE $1.8T_{CN}$

$Q_P = A_B / P(12 \times 60)$

$= A_B / 720P$

PER KINGS COUNTY METHODOLOGY APPLY SAFETY FACTOR OF 2.0 TO PERC RATE.

$Q_P = A_B / 2 \times 720P$

$V_P = (60)\, 1.8T_{CN} A_B / 1440P$

$$\boxed{V_P = .075 T_{CN} A_B / P}$$

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BASIN SIZE DESIGN FORMULA

$$V_N = V_B + V_P$$

$$\boxed{54 T_{CN} Q_N = A_B d + .075 T_{CN} A_B / P}$$

NOTES:

1. DESIGNER TO ASSUME EITHER BASIN DEPTH OR BOTTOM AREA.
2. MAXIMUM STORAGE VOLUME ALWAYS OCCURS AT OR BEFORE $1.8 T_{CN}$.